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JUNE

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July 21-25

AMERICAN DENTAL ASSOCIATION
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Rocky Mountain National Park, Colorado

SEVENTY-SECOND ANNUAL SESSION, AMERICAN DENTAL ASSOCIATION
Denver, Colo., July 21-25, 1930

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COMMITTEE ON LOCAL ARRANGEMENTS
SEVENTY-SECOND ANNUAL SESSION, AMERICAN DENTAL ASSOCIATION
Denver, Colo., July 21-25, 1930

THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

Vol. 17 JUNE, 1930 No. 6

Original Communications

RELATION OF DIET TO GENERAL HEALTH AND PARTICULARLY TO INFLAMMATION OF THE ORAL TISSUES AND DENTAL CARIES*

By MILTON THEODORE HANKE, Ph.D., Chicago, Ill.
(In collaboration with the Chicago Dental Research Club)

IN a paper presented before the Chicago Dental Society in May, 1929,[1] we called attention to the fact that the majority of people are eating food that is deficient in vitamin C. Dental disorders were almost invariably found to occur in persons whose diet is deficient in vitamins and, conversely, a freedom from dental disorders seemed, as surely, to be enjoyed by persons that were eating food that contained an abundance of vitamins. The important factor appeared to be vitamin C. The calcium and phosphorus values of the blood were never found to be markedly subnormal, an apparent parathyroid deficiency was never encountered and a *marked* vitamin D deficiency was the exception rather than the rule. Conclusions were reserved for a later date because sufficient time had not elapsed to warrant a dogmatic opinion.

These studies have been continued, and we are today prepared to give a statistical report on 191 cases and a record of improvement in 104 cases. The method used in compiling this report is similar to that previously employed.[1]

The members of the Chicago Dental Research Club have supplied most of the patients and the dental information and have usually induced the patients to supply a set of dental roentgenograms. I have interviewed the patients, examined their mouths, questioned them rather fully on their general state of health with special reference to gastro-intestinal disturb-

*Read before the Section on Mouth Hygiene at the Midwinter Clinic of the Chicago Dental Society, Jan. 14, 1930.

*From the Otho S. A. Sprague Memorial Institute and the Department of Pathology, University of Chicago.

1. Hanke, M. T.: Relation of Diet to Caries and Other Dental Disorders, J.A.D.A., 16: 2263-2271 (Dec.) 1929.

TABLE 1.—Relation of Dietary Deficiencies to Gingival Irritation, Pyorrhea and Dental Caries*

Age Range	No Dental Disorders				Caries				Caries and Gingival Irritation				Gingival Irritation and (or) Pyorrhea. No Caries.			
	Group 1 Dietary Deficiency				Group 2 Dietary Deficiency				Group 3 Dietary Deficiency				Group 4 Dietary Deficiency			
	None	C & D	C	D	None	C & D	C	D	None	C & D	C	D	None	C & D	C	D
0–10	2	1				2	6			7	1				1	
11–20	4		2	1		10	21			7	10			3	2	
21–30	1			1		7	4			13	6			3	7	
31–40			1			3	6			8	3			5	3	
41–50	2						2			3	5			4	10	
51–up	2										2		1	4	5	
Totals	11	1	3	2	None	22	39	None	None	38	27	None	1	19	28	None

*The total number of cases studied was 191. Of these, 17 (8.9 per cent) were free from dental disorders. The diet of only one of the seventeen persons was markedly deficient in vitamins. The diets of the 174 persons that were afflicted with some kind of dental disorder were all deficient in vitamin C, and of these, 94 (54 per cent) were eating diets that were deficient only in vitamin C. None of these persons were eating diets that were deficient only in vitamin D.

ances, nervous tendencies and possible endocrine deficiencies, made a thorough study of their previous diet, examined the blood for calcium and phosphorus and usually for other constituents, determined blood pressure, weight and height and noted the quality of the muscular tissue, and frequently conducted a urine analysis, and have then made the necessary recommendations. The sum of this information makes it possible to draw fairly accurate conclusions as to the person's state of health, the dental condition and the vitamin intake.

The record on 191 cases has been completed to date. This includes, of course, only those cases in which we have been able to obtain information that is unquestionably reliable and adequate for our purposes. The results are summarized in Table I.

For the sake of convenience, the dental disorders have been divided into four groups: 1. No dental disorders now. 2. Caries. 3. Gingivitis or pyorrhea and caries. 4. No caries. Other conditions as in Group 3.

You will note that seventeen of the 191 persons were free from dental disorders and, of these, eleven were eating a diet that contained ample vitamins. One of these patients, a boy of 17, was eating food that is unquestionably deficient in vitamin C. He had not developed any dental diseases, but his general health was poor. The dietary deficiency was slight in the remainder of these cases.

The uncomplicated caries group (Group 2) comprises sixty-one cases. The diets were invariably deficient in vitamin C, and in thirty-nine of these cases, there was no other demonstrable dietary deficiency. It is possible, therefore, to have active caries in persons whose blood calcium and phosphorus are normal and whose diet is, apparently, not deficient in vitamin D.

Caries, associated with gingivitis (Group 3), was encountered in sixty-five cases. The diets were invariably deficient in vitamin C, and in twenty-seven of these cases, there was no other demonstrable dietary deficiency. A deficiency in both vitamins C and D was prevalent in this group (thirty-eight cases).

Of the forty-eight persons represented in Group IV, thirty-four had pyorrhea. Caries was absent in all cases. One of these patients was obtaining an abundance of vitamins. The marked gum irritation, with which she had been afflicted for some time, proved to be due to occlusal trauma. With this one exception, the diets were invariably deficient in vitamin C, and in twenty-eight of these cases there was no other demonstrable deficiency.

This survey gives values that are almost identical with those previously obtained in a smaller group. The inevitable conclusion again is that a lack of vitamin C may be an important factor in the initiation of dental diseases.

That we may not be misunderstood, it may be well to state that we are not of the opinion that any syndrome is specifically due to the direct effect of a lack of any one vitamin. Many factors are involved in the proper functioning of any body cell, and all of the body hormones and all of the vitamins are, probably, equally important in maintaining a cellular condition that is efficient. We have been placing particular stress on vitamin C because it is just *the* factor in which the majority of diets are deficient. The food that we have been advocating contains, as far as we now know, all of the factors that are essential for health. This consists, usually, of milk, from 1 to 2 pints a day, meat, fresh vegetables,

Fig. 1.—Gingival tissue of excellent quality. This patient has been ingesting the diet, previously described, for one year.

Fig. 2.—Gingival tissue of good quality in spite of the fact that the teeth are heavily covered with plaques. The plaques have been revealed, for photographic purposes, by means of Bismarck brown disclosing solution (formula and technic given at end of text).

Fig. 3.—Thick firm gingival tissue of good color. The thickening is not due to a subgingival calculus.

Fig. 4.—Soft gingival tissue, with almost no thickening, especially noticeable around the lower teeth. The color suggests a hyperemia and microscopic examination reveals the presence of numerous short, thick blood vessels. These are never seen in healthy gingival tissue.

Fig. 5.—Soft gingival tissue that is very thick and of poor color but does not bleed when brushed. The microscopic examination reveals a stage of congestion far greater than that represented by the condition in Figure 4.

Fig. 6.—A typical example of spongy gingival tissue.

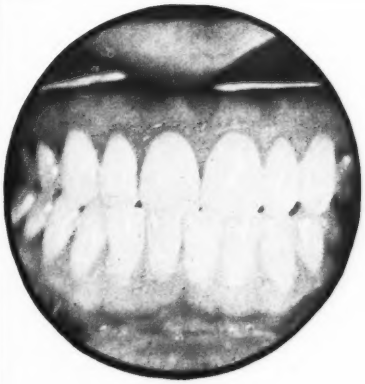

FIG. 1

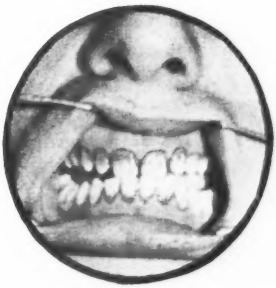

FIG. 2

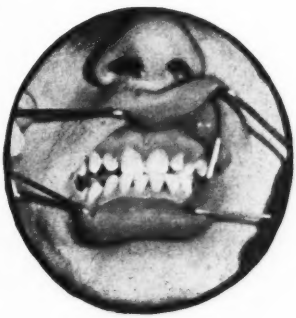

FIG. 3

FIG. 4

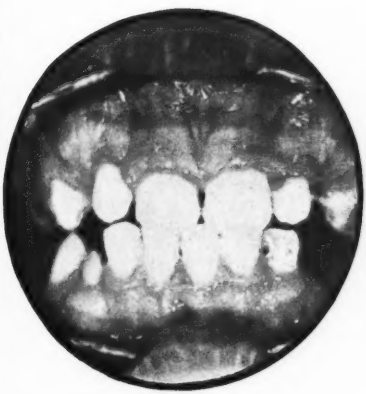

FIG. 5

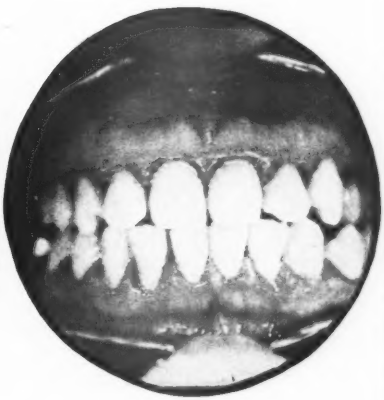

FIG. 6

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from one-fourth to one-half a head of lettuce a day, the juice of one-half lemon and one-half pint of orange juice once or twice a day, this depending on the age of the individual and on the susceptibility to a vitamin C deficiency, one or two eggs a day and any desired amount of fresh fruit.

We have, perhaps, stressed the essential *quantity* of certain of these foods more than has, heretofore, been the case. This has been due, largely, to the fact that we watched these patients closely for results and have, quite empirically, increased the intake of certain factors until a quantity was being ingested that produced the desired results (usually a solidification of the gum tissue and a tendency for this tissue to adhere firmly to the supporting tissue). The most potent factor in this diet is, unquestionably, the orange and lemon juice; and it is effective only when it is given in much larger amounts than have heretofore been generally advocated. Our initial recommendation was that the juice of one lemon and two large oranges be taken every day. This is approximately half a pint of combined juice.

The results were very gratifying. Gingivitis decreased rapidly in most cases and disappeared completely in many cases. This quantity appears, also, to have been sufficient to check dental caries because none of the earlier patients have developed new cavities (period, one year). A number of patients that were improved did not show the marked improvement that had been observed in others; so we increased the dosage to the juice of one-half lemon and one-half pint of orange juice twice a day. This has appeared to be adequate in all cases, and this is the amount that we have recommended during the past eight months. We have recommended orange and lemon juice because it is, so far as we now know, the most concentrated source of vitamin C, and it seldom leads to physical disturbances. A diarrhea that may occur in some cases soon after the diet is instituted will almost invariably disappear in two to four days. An idiosyncrasy to citrus fruit is so rare that, of about 500 persons that I know of who are ingesting a pint of orange and lemon juice a day, not one has developed any allergic symptoms. Of the other important sources of vitamin C (tomatoes, cabbage and lettuce), we have advocated only the latter, and then not particularly because of its vitamin C content. Tomatoes are, unquestionably, a good and fairly inexpensive source of vitamin C; but the protective quantity is rather more than most persons would care to take consistently, and tomatoes frequently lead to gastro-intestinal disturbances. Most of our patients have, of course, been eating both tomatoes and cabbage as adjuncts to the food more specifically recommended.

A curious quantitative relationship should be mentioned in passing. The recent work of Eddy[2] has shown that 3 c.c. of orange juice per day is required by a 1-pound guinea-pig to insure freedom from changes in the pulps of the teeth. If we assume that man and the guinea pig are equally susceptible to a vitamin C deficiency, a 150-pound man would require 450 c.c. (1 pint) of orange juice a day. This is, indeed, the amount that we have empirically determined to be adequate.

Considerable has been written about vitamin C, and we shall probably have more to say about this substance. It should be remembered that we have not, and do not claim to have, proved that

2. Eddy, W. H.: An Improvement in the Quantitative Assay of the Antiscurvy Vitamin (C).

this vitamin is the potent factor in our diet. We believe that it is the potent factor because the changes that we have observed in the gingival tissues are exactly those that one would expect to obtain after the administration of vitamin C; but what we have really shown is that certain changes are produced by certain foods. The potent constituents of these foods may or may not be vitamin C, or, for that matter, any vitamin; but the effects are undeniable, and this is, after all, the most important consideration. Time will tell whether the theory that led to the feeding of these foods is or is not correct.

A diet such as has been described above has now been recommended to about 500 persons. Some of them have and others have not cooperated. In this group, an accurate series of re-checks over a sufficient period of time has been completed in 104 cases. Table 2, which summarizes these results, represents a great variety of conditions and a varying time of observation that are not easily tabulated. We have had patients with almost every conceivable type of gingivitis, with and without carious lesions, and cases of pyorrhea that varied from a shallow purulent infection to one in which there had been a profound involvement of the supporting bone. None of the patients have been under observation for less than four months, and many of them have been observed by the same dentist for from ten to twenty years. Gingival changes occur rapidly; but it would be quite irrational to draw conclusions about dental caries only when the patients have been carefully observed for at least eight months.

By arrested caries we mean that, to the best of their ability and frequently with the aid of roentgen rays, the dentists have been unable to find any evidence of new carious areas, nor have they observed an increase in the size of the lesions that were present. We all realize that eight months is too short a period, under imperfectly controlled conditions, in which to draw radical conclusions about dental caries. We have under way, at the present time, an extensive program which will enable us to ascertain, under highly controlled conditions, whether or not the conclusions that we are tentatively drawing at the present time really represent the truth.

The outstanding result of the dietary treatment has been the improvement in general health. The patients have almost invariably observed an increased alertness and an increased ability to work or play without fatigue. A number of patients, both children and adults, that were quite obviously underweight have gained from 10 to 30 pounds during a three-month period. This has not been a constant finding. The weight of the frankly obese patients has not been influenced particularly. The resistance to infection appears also, in many cases, to have been materially increased. This was particularly noticeable in patients that had, previously, been constantly afflicted with head colds. In one case, a severe osteomyelitis of long standing has been completely cured. Our findings are, on the whole, in rather close harmony with those reported by Lovell Langstroth, who recommends a diet very similar to the one that we have been advocating.[3]

Of the 104 patients, fifteen did not cooperate at all. None of these cases showed any spontaneous improvement and a few of them became worse. Sixty patients who had previously been afflicted with an active, progressive decay have

3. Langstroth, Lovell: Relation of American Dietary to Degenerative Disease, J.A.M.A., 93:1607, 1929.

TABLE 2.—Improvements Associated with Changes in Diet*

Previous Vitamin Deficiency	Added to Diet				General Health After Treatment			Dental Condition After Treatment		
	No addition	Vitamin C	Vitamin C & D	Vitamin D	Improved	Unchanged	Worse	Decay arrested	Gum condition or pyorrhea improved or cured	No improvement
Vitamins C and D	5					4	1			5
		3			3			1	3	
			36		34	2		20	29	
				1		1				1
Vitamin C	10					6	4			10
		49			43	6		29	39	1

*The total number of persons studied was 104. Of these, fifteen did not cooperate at all. They were either not improved or became worse. Perfect cooperation was obtained from eighty-five patients. A marked improvement in general health was obtained except in those cases in which the general health had previously been excellent. Gingival irritation (Vincent's infection, gingivitis or the inflammation associated with pyorrhea) was invariably improved or cured. Sixty patients in whom caries had previously been active have remained free from caries for eight months.

not developed new carious lesions, nor have the existing, unfilled lesions increased in size during an eight-month period.

Healthy gum tissue should be firm and should be firmly attached to the supporting structures. A really good quality of gum tissue is the exception rather than the rule. We have attempted to record gum structure by taking colored photographs of the mouth. The accompanying illustrations are representative of the conditions that are most common. The gums may be firm and of good color, but thick. The thickening occasionally observed is a bulge due to a submerged calculus. This has been demonstrated by actually removing the subgingival calculus. Such a condition cannot, of course, be corrected by dietary methods. This thick but firm type of gum tissue has been reduced to normal in a number of cases in which a subgingival calculus was not demonstrable, purely by dietary management. The observations of Wolbach, presented before this society, afford an excellent explanation for the cause of the thickness of these gums as well as for the fact that the ingestion of citrus fruit reduces the gums to a normal state. The thickening may well be due to the presence of an abnormal amount of fibrous tissue.

The soft, sometimes hypertrophied, type of gum tissue is very common. The color may or may not be good. The tissue offers little resistance when it is gently pressed with a metallic instrument. This slight pressure is usually followed by a momentary depression in the gum tissue that reminds one of an edematous condition. This is then followed by a temporary excessive redness of the injured area. Such gums do not bleed easily. A microscopic examination of the gingival tissue in the living subject reveals, under 30 diameters magnification, a surface that contains many short but thick blood vessels that are far larger than a normal capillary and that are easily visible. Healthy gingival tissue never has this appearance. Soft gums almost invariably become firm after from thirty to sixty days of dietary management. The previously noted surface vascularity disappears.

The spongy gum, though not so common as the soft variety, is, none-the-less, rather frequently encountered. This, as we see it, merely represents a state of deficiency greater than that represented by the soft gum. The entire gum tissue may be spongy or the condition may be such that the soft gum tissue is interspersed with spongy areas. Spongy gums bleed easily. They are soft, thick and water-logged, and have no resiliency. The color is usually dark red and may be tinged with blue. The frankly infected surfaces of spongy gingival tissue consist of a structureless mass of dead tissue. The smooth intact adjacent surfaces are markedly hyperemic.

The acute inflammatory reaction in spongy gums usually subsides after from fourteen to thirty days of dietary management. The spongy gums that bleed easily are thus converted into soft gums that do not bleed even though they are brushed rather vigorously. The soft gums eventually become firm as outlined above. Table 2 shows an improved gum condition in seventy-two cases. This change is so obvious and has been observed so frequently (far more frequently than is indicated by the table) that we feel justified in concluding that many types of gingival abnormality are due to a dietary deficiency and the condition can be corrected by means of a diet such as we recommend.

We fully recognize the fact, of course, that bleeding of the gums is frequently associated with a possible local irritant. This local irritant may be mechanical (malocclusion) or it may be calculus or it may be bacteria. Gingival irritation that is due to malocclusion can hardly be remedied except by correcting the occlusion. Gums can seldom be made to take kindly to calculus even though the diet is perfect; but we have seen cases in which even this did occur. The presence even of thick bacterial deposits along the gingival margins does not, necessarily, indicate that the gums must be of poor quality. It is really easier to get people to eat good food than it is to get them to brush the teeth properly.

A correction of the gingival condition has usually occurred in spite of the presence of bacteria. We have, in our laboratory, two young men who are very susceptible to a vitamin C deficiency. The one does not ever clean his teeth well. It is possible, in this case, to produce an excellent, firm, gingival tissue in two weeks by feeding an abundance of orange and lemon juice (in spite of the bacteria), or, conversely, these gums will become spongy and bleed easily if the citrous fruit is withheld for two weeks. The other young man, on one occasion, went for thirty days without cleaning his mouth at all. (The diet was excellent.) At the end of this time, the teeth were heavily coated with plaques and the gums were coated with a bacterial film; but the gingival tissue was firm and of excellent quality, and there was no irritation at the gingival margins.

We come now to the condition that is called pyorrhea. We are frequently asked if we can cure pyorrhea. The answer will depend largely on what you would call a cure and on what you call pyorrhea. This condition may vary from a simple, shallow purulent infection to one in which there is a profound involvement of the bone with large deep pus pockets and teeth that are, literally, floating. Between these extremes one can have almost any condition. An attempt to treat a pyorrheic condition without prophylaxis has been made in only one case. This heroic experiment was carried out by one of our group and it was successful.

It would, under ordinary circumstances, be pure folly to attempt to free a deep pus pocket from infection without introducing drainage or irrigation. An attempt has almost invariably been made, in our cases, to remove the pus and the infected bone as far as possible. The rapidity with which complete healing will occur in the very severe cases depends largely on how carefully and completely the infected bone is removed. A combination of good surgery and good food has led to many complete cures within sixty days. A good brushing technic has also been used. Brushing the gums toward the teeth not only produces an additional circulatory stimulus (vitamin C being one circulatory stimulus), but it also helps to empty the pus pocket, i. e., it helps to create drainage. We cannot say, therefore, that we have treated pyorrhea by purely dietary means. The results obtained have been due to a combined mechanical and dietary effort.

Simple, shallow purulent infections yield rather easily. The deeper the infection and the larger the pocket, the harder it is to effect a freedom from pus; but this ideal has been realized in a number of very bad cases even though the surgery was not always ideal. I have seen patients in whom bone curettement had not been resorted to, with an initial eight to twelve deep purulent pockets, return periodically with fewer involved

teeth at each visit. Months are required to effect a complete cure unless drastic curettement is resorted to. It must also be remembered that a pocket full of pus always represents a possible rapid invader. Food alone cannot completely counteract the ravages of lack of sleep or of worry; and a number of patients that have shown marked signs of improvement have had relapses following family catastrophies. On the whole, most pyorrhea cases can be rendered pus-free by a combination of proper prophylactic treatment and dietary management.

We can say but little with regard to the much mooted question of bone regeneration. We have seen cases in which there has, unquestionably, been some bone regeneration; but we have seen others in which there has just as certainly been no bone regeneration. We do not have any case in which bone destruction has continued after combined mechanical and dietary management was instituted.

A solidification of the teeth has been noted frequently, though not invariably. A tooth that is not surrounded by any appreciable amount of supporting bone can hardly become solid; but cases in which sufficient supporting bone remains will become fairly or quite solid as soon as the pericementum and the gums have become healthy. A healthy gum tissue will attempt to adhere firmly to the supporting structures.

Several of our group have had patients in whom the gum recession and bone absorption had proceeded to such an extent that the bifurcation of the roots of the molars protruded above the visible gum line. The combined mechanical and dietary treatment soon removed the pus. The gums attached themselves firmly to the supporting tissue; and these teeth are now quite solid although a space is present below the projecting root bifurcation and the gum tissue. In one case, with an initial purulent involvement of ten teeth, nine have become free from pus and are quite solid and the one remaining pus-surrounded tooth gives trouble periodically because the upper gum tissue tightens around the supporting structures, a closed pocket is produced and the pressure that is caused subsequently leads to considerable pain.

The foregoing considerations indicate that diet is an important factor in preventing and in combating inflammation of the oral tissues and suggests that carious lesions may be an evidence of malnutrition and that further progress of this disease can be checked by proper diet.

Although the dietary management has been useful as a mode of treatment, it should be advocated most strongly as a preventive measure. Dietary management should most certainly begin with the pregnant woman, not only because of the most immediate effect on herself but also because of the action on the fetus. Subsequent proper systematic nourishment of the child may lead to a decreased incidence of oral inflammation and possibly of dental caries.

A 2 per cent solution of Bismarck brown, prepared in one of two ways, is suitable for a disclosing stain. Bismarck brown, 2 gm., is dissolved in 100 c.c. of (1) a 25 per cent (by volume) solution of glycerol; or (2) a 20 per cent solution of alcohol. The second solution stains plaques very rapidly and intensely. It has the disadvantage of occasionally staining the clean enamel a pale shade of brown. The first solution stains the plaques more slowly, but quite intensely, and it does not stain enamel. Either solution will impart a brown color to inflamed gingival tissue. The Bismarck brown stain is better for our purposes than Skinner's disclosing solution because the color remains for from thirty to sixty minutes. All mouths should be brushed for one and one-half minutes with a soft toothbrush and

water before the stain is applied. This treatment does not remove plaques, but it does remove the thin film of mucin present on all gingival tissue and on all teeth, which would otherwise acquire a brown color, this fact leading to erroneous conclusions.

SURGICAL TREATMENT OF ACCIDENTAL WOUNDS OF THE MOUTH AND FACE, WITH SPECIAL REFERENCE TO THOSE COMPLICATED BY BONE INJURY*

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THE increasing frequency of injuries to the soft tissues and bony framework of the face, especially as the result of automobile accidents, has created a special field for cooperation of the surgeon and the dentist, a field which proved its value in the treatment of war injuries of the face and jaws. There are very few men with the skill and inclination to handle alone all the aspects of these cases, including the surgical, the dental and the prosthetic.

Unfortunately, it has been rather difficult to find men practicing dentistry, even though they are specialists in prosthodontia, who are sufficiently familiar with the prosthetic requirements of these cases, or who are able to devote sufficient time to the making of necessary appliances. The surgeon is, therefore, frequently handicapped by the lack of proper splints and other apparatus, and it has often been necessary to resort to expedients or makeshifts which served the purpose in a way, although, with the proper cooperation, the case could have been handled much more efficiently.

At the Walter Reed General Hospital, a very different state of affairs exists from that obtaining in civilian practice. Here, there is a personnel thoroughly equipped to handle these injuries of the face and jaws from the standpoint of the surgeon, the dental surgeon and the prosthetist. The officer responsible for splints knows just what is wanted and what will work best in a given case, and he is able to turn out the appliance in the shortest possible time. Those interested in this aspect of the work should consult the articles on maxillofacial prosthesis, by Roy L. Bodine,[1] the first published in November, 1928.

Injuries may vary from slight scratches and bruises to total destruction of a part. They may be limited to the soft tissues alone or may also involve underlying bones.

Wounds may be divided into four general classes:

1. An incised wound is one in which the tissues are clean cut by a sharp object, without bruising. The vitality of the tissues is but little impaired, and conditions are most favorable for healing without sepsis.

2. A lacerated wound is one in which the tissues and skin edges are torn, rather than clean-cut.

*Read before the American Society of Oral Surgeons and Exodontists, Washington, D. C., Oct. 4, 1929.

1. Bodine, R. L.: Maxillofacial Prosthesis, Internat. J. Orthodon., 14:998 (Nov.) 1928.

3. A contused wound is one made by a blunt force, in which the vitality of the tissues involved may be greatly impaired, with probability of sepsis and sloughing, and consequent interference with healing.

4. A puncture or stab wound is a wound of great depth compared with its surface extent. Superficial examination of such an injury may leave one in considerable doubt as to the extent of the damage. If it is made by a clean, sharp object, healing may take place with no difficulty; if made by a blunt object, such as a stick, the element of contusion of the tissues is added. Foreign bodies, such as dirt and pieces of clothing, carried into the deeper tissues, add to the probability of sepsis.

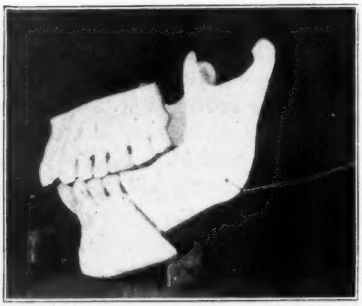

Fig. 1.—Method of controlling edentulous posterior fragment of mandible by wire passed through hole drilled in angle to afford attachment for backward and downward elastic traction.

Gunshot wounds, which are met with in civil as well as in military practice, vary according to the nature of the missile; the velocity at which it strikes the body; whether bony parts are involved, etc. A pistol bullet, fired at short range, may make a mere puncture wound through the soft tissues, even drilling a clean hole through a bone, and pass out of the body with little damage. Coming from a greater distance with less velocity or ricocheting from an intervening object, the bullet may be changed in shape and cause extensive laceration and contusions, with great shattering of bone. The bullet, or pieces of it, may remain embedded in the tissues. When a through and through wound is produced by a bullet, the wound of entrance may be quite insignificant, and the wound of exit much larger, owing to change in shape of the missile in its passage through the tissues. In a bullet wound about the face, when only one break in the skin is found, it must not be taken for granted that the bullet is necessarily embedded in the tissues. The missile may have made its exit or entrance through the open mouth. Wounds about the

Fig. 2.—Backward and downward traction on edentulous fragment by wire passed through angle of mandible and attached to plaster head cap by means of elastic band.

mouth and jaws always carry with them the added element of sepsis from bacteria in the saliva.

TREATMENT OF WOUNDS

Accidental incised and lacerated wounds about the face, commonly produced by pieces of broken windshield glass, may vary greatly in depth and extent. The first consideration in treatment here, as in all wounds, is arrest of hemorrhage. If it is profuse, the bleeding vessels should be found, clamped with artery forceps and ligated. The wound should then be thoroughly cleansed, and all foreign particles, such as glass, dirt and clothing, removed. The edges are then to be sutured accurately. Proper coaptation of edges in their normal position at this time will generally render later corrective plastic surgery unnecessary. Clean-cut face wounds, even deep ones, may usually be closed without drainage, especially if seen early. A wound extending completely through the cheek or lip into the mouth requires sutures for the mucous membrane as well as the skin. Several materials may be used for sutures, such as horsehair and silkworm gut. For skin and mucous membrane, we usually employ dermal suture, a prepared silk. This is more dependable than horsehair, and does not remain stiff in the mouth, causing irritation, as is sometimes the case with horsehair.

Fig. 3.—Case shown in Figure 2; control of main fragment of mandible by lock-pin cast splints on upper and lower teeth.

Fig. 4.—Case shown in Figures 2 and 3; after bone grafting to fill jaw defect and removal of apparatus; showing satisfactory restoration of function.

We are more especially interested in the graver wounds which involve the

maxillary bones as well as the soft tissues. As examples, among recent cases may be mentioned: multiple fractures of the mandible and lacerations of the face from a fall from a moving automobile; bilateral horizontal fracture of the upper jaw, with backward and upward displacement, resulting from the face striking against the steering wheel in automobile collision; bilateral fracture of upper jaw with forward displacement and contused wound of right cheek, opening into antrum, resulting from injury to the face from a falling steel window sash; gunshot wound of the upper part of the face, causing comminuted fracture of the left upper jaw, loss of the left eye and destruction of the soft tissues; gunshot wound of lower part of the face, causing bilateral fracture of the mandible and loss of soft tissues. Many of these severe injuries of the face and jaws are complicated by cerebral concussion, with or without fracture of the skull.

Fig. 5.—Double fracture of almost edentulous mandible satisfactorily treated by three circumferential wires twisted over lower denture.

The general principles of treatment of such a case may be outlined as follows: (1) arrest of hemorrhage, the first and most urgent consideration; (2) treatment of shock, which is next in importance; (3) immediate administration of antitetanic serum, and care of the injury itself.

As soon as the general condition permits, an examination of the wound is made to ascertain its extent, the structures involved, the position of the fractures, and the presence of foreign bodies. Roentgen-ray examination should be made to show the position of the fractures and to locate foreign bodies. A general cleaning up of the wound is now undertaken. The surrounding skin should be thoroughly cleansed with soap and water, and foreign material, such as dirt, stones, broken teeth and bullet

Fig. 6.—Double fracture of edentulous mandible. Forward traction of chin fragment by circumferential wires attached to bars extending down from plaster-of-Paris head cap.

particles, removed. It may not be possible to remove all foreign bodies at this time. All devitalized soft tissue should, if possible, be cut away. Any completely detached bone fragments should be removed. But bone fragments having any attachment to the soft tissues should be allowed to remain, as they frequently keep their vitality and aid in preserving continuity of bone. It is much wiser to leave a bone fragment of doubtful vitality, and to remove it later in case of necrosis, than to perform a radical débridement of all loose fragments with resultant bone defects requiring grafting later.

Fig. 7.—Improvised splint for upper jaw fracture made from impression tray and attached to teeth by impression compound.

Fig. 8.—Bilateral fracture of upper jaw with forward displacement. Apparatus shown in Figure 7 connected by elastic bands to plaster-of-Paris head cap.

At this time, the fractures should be reduced to as nearly correct position as possible, and held with interdental wires or splints. It may be difficult, at this early stage, to apply elaborate splints, so we usually rely on wires or arches attached to the teeth, at least temporarily, and many times these temporary expedients suffice throughout. We believe that restoration of bone fragments to approximately normal position and fixation there should be done as soon as the patient's general condition permits. We find that if this is done early, the patient will be more comfortable and sepsis will be less. The fractures should be reduced before closure of the wound in the soft tissues, because, if they are allowed to become fixed in malposition, reduction later may require extensive operation, entailing great loss of time. Reference will be briefly made here to some of the methods used for maintaining bone fragments in position.

Mandible.—In the lower jaw, we have found that wiring the lower teeth in occlusion with the upper, according to the principle of Gilmer, is the simplest and most efficient method of fixation for the great majority of cases. Modifications of technic are made necessary, according to the number of teeth present, presence of edentulous fragments, etc. For cases with practically complete dentures, the eyelet method, as developed in the U. S. Army, is most easily applied, and permits easy access to the inside of the mouth when occasion arises.[2] If several teeth are absent from either jaw or both jaws, Gilmer's method of applying a German silver arch to the labial and buccal surfaces of the teeth of each jaw and then connecting the upper and lower arches by brass tie-wires is very satisfactory. We find that half-round arch wire is more easily applied than round wire. The gradual elastic reduction principle as embodied in Leo Winter's arches, provided with hooks (modified Baker anchorage), is useful in partly consolidated fractures with malocclusion. For control of long edentulous posterior fragments in a bilateral fracture, Darcissac,[3] through a small skin incision, drilled a hole through each angle of the mandible for the passage of a wire (Fig. 1). He then connected each wire with its fellow of the opposite side around the back of the patient's neck by a heavy elastic band. This made sufficient traction to overcome the upward muscular pull and held the edentulous fragments down and out in satisfactory position. With a unilateral fracture of this kind, in several cases, we have made backward and downward traction on the edentulous fragment by connecting the wire to a plaster-of-Paris head cap by means of an elastic band. The application of a very satisfactory head cap has been described by Scogin.[4] (Figs. 2-4.)

Fig. 9.—Side view of case shown in Figure 8; upward and backward traction on upper jaw; upper teeth, which were 2 cm. in advance of normal position, completely reduced in ten days.

In completely or almost completely edentulous cases, the principle of circumferential wiring of the bone over an artificial denture or intra-oral splint has proved of great value. (Fig. 5.) In a recent case of bilateral fracture of an edentulous mandible with backward displacement, the chin was held in a forward position by two 24-gage brass wires passed, under local anesthesia, around the bone through skin incisions at the lower

2. Ivy, R. H., and Curtis, Lawrence: Fractures of Mandible, Dent. Cosmos, 68:439 (May) 1926.

3. Lenormant, C., and Darcissac, M.: Bull. et mem. Soc. nat. de chir., 53:503 (April 2) 1927.

4. Scogin, C. W.: Internat. J. Orthodon., 14:526 (June) 1928.

border of the mandible and fastened to iron bars made of coat hanger wire extending downward from a plaster-of-Paris head cap. (Fig. 6.) This apparatus was worn for four weeks.

Upper Jaw; Unilateral Fracture.—Most cases are successfully treated by pushing the fragment back into place until the teeth are in occlusion, and then wiring the teeth of the sound side of the maxilla to those of the lower jaw. In bilateral fracture of the upper jaw, support should be obtained from the bones of the skull by means of a head apparatus, as described by Marshall.[5] A vulcanite or metal splint is attached to the upper teeth. From the splint, heavy metal bars emerge at the corners of the mouth, passing back for a distance over the cheeks. A plaster-of-Paris skull cap is made in which are embedded straps or hooks which can be connected with the bars emerging from the mouth to make traction in the desired direction. When reduction has been obtained, the upper and lower teeth can be fastened in occlusion until consolidation is complete. Downward movement of the mandible can, if necessary, be restricted by a chin cap connected to the head apparatus. In order to avoid the necessity of taking impressions of the teeth for the making of a special splint, we have several times improvised a Marshall apparatus by attaching heavy bars to a light impression tray and fixing this to the upper teeth with impression compound and wires. (Figs. 7-9.)

Some of the above-described contrivances have enabled us to give immediate and satisfactory attention to hospital cases, where dental laboratory cooperation is often difficult or impossible to obtain.

5. Marshall, J. S.: Injuries and Surgical Diseases of Face, Mouth and Jaw, Ed. 3, 1909, p. 230.

After attention to the bony part of the injury, the soft tissue wound is cared for. In deep contused wounds involving the bone, complete closure by suture is seldom wise. Provision should always be made for drainage. In the upper part of the face, it is sometimes permissible to close the skin wound entirely, providing gauze or rubber drainage from the deeper tissues (maxillary sinus, etc.) into the mouth. In wounds of the lower part of the face, mandible and floor of the mouth, external drainage on to the neck should always be provided. During the acute inflammatory reaction, hot boric acid or magnesium sulphate fomentations are helpful. Throughout the course of treatment, the mouth and the appliances should be kept clean. Sometimes, the patients themselves cooperate very well in this; but in other cases, everything has to be done for them. After every feeding, the teeth and the appliances should be swabbed with hydrogen peroxid on cotton applicators and the mouth irrigated with any good mouth wash, such as liquor antisepticus. In case of suppuration, the wound should be flushed twice daily with an antiseptic solution. Potassium permanganate 1:6,000 is very useful. From time to time, small loose sequestra may be removed, or larger ones may require operative measures under an anesthetic. Feeding is of the utmost importance, since the patient frequently has to be limited to liquids for several months.

Complications.—With proper early reduction and fixation of bone fragments, and replacement and suture of overlying soft tissues, many cases go on to uncomplicated recovery. Unfortunately, the patient's general condition is frequently so grave as to delay the institution of corrective measures, and it is sometimes weeks before the specialist is called in.

Often, the primary injury is such that extensive destruction of bone or soft tissues interferes with an uncomplicated return to normal.

Secondary infection and lack of early treatment are important factors in deformity on healing. This leads to the necessity of various plastic operations for reduction of scars and the building up of lost parts of soft tissues and bone. No major reconstructive operations should be attempted until after healing has taken place and until infection has been eliminated as far as possible. Permanent losses of bone in the upper jaw, generally speaking, are best restored by intra-oral prosthetic appliances. In the lower jaw, losses of bone continuity, even up to 3 or 4 inches, can be successfully restored by bone grafting.

ORAL DIAGNOSIS*

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UNDOUBTEDLY, the subject of oral diagnosis has achieved an outstanding place in dentistry, primarily through the efforts of the medical profession in bringing to light the problem of focal infection and its bearing on systemic disease.

As early as 1818, Benjamin Rush[1] reported "a connection between the extraction of decayed and diseased teeth and the cure of general diseases. . . ." Little attention was directed to the mouth as a possible source of infection until the memorable address of Hunter[2] in 1910, wherein he emphasized oral sepsis as a distinct factor with which to be reckoned. The problem of oral focal infection is still controversial and debatable, yet much evidence has been presented to prove the relationship of diseased teeth and abnormal mouth conditions to pathologic manifestations elsewhere in the body. Thus was the profession of dentistry awakened to the responsibilities involved in the care of the mouth, with the full realization that the diagnosis and treatment of disease in general, as well as oral conditions, could not result unless cooperation existed between the physician and the dentist. To this end, both professions have earnestly labored, with the result that humanity has benefited to a vast degree.

Theoretically, oral diagnosis should have a wide-spread appeal, as its scope embraces practically every phase of dentistry; but, unfortunately, too little attention is given by the average practitioner to a systematic survey of the mouth, he being content to relieve the pain and suffering that has brought the patient to him, and neglecting or overlooking other conditions that will destroy the dental apparatus.

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 8, 1929.

1. Rush, Benjamin: Medical Inquiries and Observations, Philadelphia: Matthew Carey & Sons, 1818, p. 1.

2. Hunter: Rôle of Sepsis and Antisepsis in Medicine, Lancet, 1:79, 1911.

Oral diagnosis, then, is a consideration of all those factors entering into a systematic survey of the oral cavity, together with a definite plan of procedure for placing the mouth in a healthy condition and making recommendations for suitable measures to restore occlusion and masticating efficiency.

Particular emphasis is to be placed on the fact that oral diagnosis should include a consideration of the type of restoration that best suits the need of the individual patient; for many a mouth, restored to a state of health, has been utterly ruined by poorly constructed and unwisely selected restorations. It is, therefore, evident that the responsibility of the dentist cannot cease until the mouth, freed of its sepsis, is restored in such a manner that oral health will continue.

In order to render adequate service to patients, it is well to consider the qualifications that must necessarily be possessed by the dentist. In addition to technical skill, he must have knowledge that embraces general systemic conditions and certain phases of general diagnosis, together with an understanding of the basic principles of medicine; or else he would not be capable of working in harmony with the physician in their mutual undertaking, the restoring of health. This statement is not to be construed as inferring that the dentist should be versed in pathology and bacteriology, as is the medical diagnostician, to the extent that he can diagnose all systemic ills; but rather it is meant that the knowledge of the dentist should be broad enough in the field of medicine that he can appreciate the significance attached to a positive reaction from laboratory tests, or the seriousness of a patient's condition as shown by the blood picture.

Before enumerating any technical procedures in an oral survey, it must be remembered that oral diagnosis, properly made, is a painstaking procedure, consuming much time and concentration and requiring constant study, observation and practice. There is no short cut method that is effective, for it is only by a correlation of all diagnostic factors that a successful end-result can be achieved. It has been truly said that if a task cannot be well done, it is better never to attempt it, and so it is with the responsibility attached to the care of the human mouth. Clinically, the mouth presents an interesting study. It has been termed the gateway of the body for sustenance, and likewise can be considered a prolific avenue of infection. With proper care and attention, the mouth can be kept clean, healthy and free from infection; whereas, neglect and inattention will bring about the opposite result, with a tendency to produce systemic complications and involvements. To restore a mouth to a condition of health and usefulness is a great responsibility, and should not be undertaken by one unqualified to render the best of service.

In conducting a routine examination, it is essential that all information gained be recorded on a suitable chart or a printed form that will contain items relative to the patient's general health, present and past illnesses and specific complaints; with the sections for the recording of the condition of the mouth at the time of examination, and for the charting of recommended restorations. Such a chart can be compiled for each patient and serve as a very valuable source of information. A simple yet serviceable procedure in checking up the oral cavity is presented in the following outline:

1. Case history and patient's general systemic condition.
2. General oral examination.
3. Roentgen-ray examination.

4. Vitality and mobility tests of the teeth.
5. Exploratory examination.
6. Study of occlusion. (Study casts.)
7. General plan of restorative work.

CASE HISTORY

All data under the head "Case History" should have reference to the general condition of the patient, and include such important items as family history, age, sex, occupation, general health, previous diseases, habits, and specific ailments. If it is warranted, the dentist should not hesitate to refer the patient to a physician for urinalysis, blood examination, blood pressure and cardiovascular information, as all of this is of much value, especially if a general anesthetic must be administered. If the patient is suspected of suffering from some serious or grave disorder, it is not only wise but also expedient that he be placed in the hands of his physician immediately, and that he remain under the care of the latter until such time as his physical condition will permit care of the mouth. Much is to be gained by close association with the physician in these cases of impaired health.

GENERAL ORAL EXAMINATION

It is in the study of the oral cavity that the dentist is really within his own sphere. As stated by Haden,[3] most oral foci of infection are the ultimate result of dental caries, pyorrhea or conditions incident to their occurrence. To prevent the occurrence of such diaster is the highest aim of the dental profession and is occupying the time and attention of a great number of research workers, but to correct oral disorders is also a big problem and will remain so as long as neglectful habits, improper diet and kindred factors will contribute to the destruction of the teeth and their investing structures.

In a general oral examination, the points to be noted should be the extent of neglect that exists, the presence of oral sepsis, inflammatory conditions and lesions; suppuration of the tonsils and gingival tissues; malformations and abnormalities of the palate and tongue, and the condition of the salivary glands and ducts. From all of these observations, much of value can be gained that will serve to help the dentist with his problem of health restoration and reconstruction work. The extent of neglect that exists in the mouth is often indicative of careless and solvenly habits of the patient, or it may mean extreme dread on the part of the patient to a dental operation. The presence of oral sepsis and inflammation and suppuration of the tissues will serve as an index as to the possible amount of absorption of toxic material; while the obstruction of salivary glands and ducts through infection or the presence of calcific deposits can result in impaired digestive processes. It is well that the general tone of the oral mucosa be observed, for it is a well known fact that syphilis, tuberculosis and diabetes play an important part in lowering the resistance of the alveolar and gingival structures. An outline devised by Mead[4] for examination of the gums is most thorough and exacting, and contains items for noting the condition of mucous secretion, color of the tissues, extent of recession and appearance of the gingival border, and inflammatory involvements of the periodontal area.

One of the most important factors in a general oral observation is the ability to recognize the oral manifestations of

3. Haden, R. L.: Dental Infection and Systemic Disease, Philadelphia: Lea and Febiger, 1928, p. 22.

4. Mead, S. V.: Diseases of the Mouth, St. Louis: C. V. Mosby Co., 1928, p. 20.

syphilis and the lesion that has precancerous possibilities, so that the patient can be placed in competent hands and early treatment be instituted. In this regard, the dentist can render a valuable service to humanity by ever being on the alert to observe a lesion or growth of questionable character early enough that treatment will be effective. Too often the mistake is made of treating lesions with escharotics or the cautery, with the result that the condition is aggravated and soon rendered hopeless. If in doubt in determining the nature of a growth, consult a competent diagnostician. The skilful surgeon, in removing a neoplasm, does not trust his own knowledge in determining its benignancy or malignancy, but refers sections of the tissue removed to a pathologist for expert opinion. Likewise, the dentist must learn to exercise proper judgment in these matters and see that every possible diagnostic aid is rendered the patients in his care.

ROENTGEN-RAY EXAMINATION

The value of a roentgen-ray examination of the teeth can no longer be questioned, for it has proved to be one of the most valuable of all diagnostic procedures. It is the only means whereby the roots of the teeth and the investing alveolar process can be studied and disease conditions and abnormalities of the teeth and osseous structures can be noted. The roentgenogram is not to be considered infallible, and its greatest value can be attained only when it is used in conjunction with clinical findings. Unfortunately, the roentgenogram does not indicate pathologic conditions in the earlier stages of disease, and is of value only in showing conditions after there has been tissue destruction.

A minimum of fourteen intra-oral exposures is essential in making a roentgen-ray survey of the teeth, for by this plan two views can be obtained of practically every tooth in the mouth, and, if necessary, these pictures can be supplemented by extra-oral lateral jaw plates in those cases in which there has been extensive tissue destruction. A lesser number of pictures than that recommended is hardly sufficient to obtain adequate information as to the condition of the teeth and jaws. While it is true that technical skill is desirable in taking roentgen-ray pictures, it is also true that knowledge of roentgenographic interpretation is all important. In roentgenographic interpretation, the following points should be noted:

1. General loss of the supporting structures of the teeth. The harmful effect of periodontoclasia on the alveolar structures is most apparent in the roentgenogram. The extent of destruction can be readily noticed, and will serve as a basis for a favorable or unfavorable prognosis in the treatment of this disease. This type of alveolar recession is not to be confused with the atrophic disturbances of the alveolar process of senile origin.

2. Presence of pulpless and periapically involved teeth. While it is not possible to determine the vitality of teeth by the roentgenogram, nevertheless it is an easy matter to recognize pulpless teeth with poor root-canal fillings or pulpless teeth with definite periapical involvements. To extract or not to extract is still a moot question, and the decision will have to depend on the factor of the health of the patient. In deciding on the problem of tooth extraction or tooth treatment, it is well to group patients as to health. An excellent classification has been presented by Hall,[5] wherein patients are arranged

5. Hall, E. M.: Pulpless Tooth Problems, Detroit: Dental Manufacturing Company, 1928, p. 16.

thus: Group 1. Patients in good health with no evidence of systemic disease. Group 2. Patients who are definitely below normal, patients with so-called degenerative diseases. Group 3. Borderline patients with more or less protracted systemic complaint of feeling weak or not up to standard. It is recommended for Group 2 patients that all pulpless teeth be removed.

3. Detection of incipient caries. The presence of incipient caries on the proximal surfaces of teeth, and gingivally to Class II fillings, can be easily discerned and notation made that correction will result.

4. The presence of root fragments and residual areas, the result of previous extractions. It is needless to say that such conditions demand thorough and careful attention, and should be eliminated as soon as possible.

5. Foreign bodies such as (*a*) fragments of filling material in a socket from previous extractions; (*b*) broken hypodermic needles; (*c*) root-canal filling material that has been forced beyond the apical foramen.

6. Presence of crowns, bridgework and other dental restorations. This is a favorable opportunity to study the type and character of the dental restorations that have been previously placed in the patient's mouth and gain an insight into their past dental experiences. Here can be noticed the gingival adaptation or lack of adaptation of crowns and fillings, and the baneful effects of poorly constructed bridge pontics that unduly impinged on the gum tissues, with resulting alveolar recession.

7. Arrangement of the teeth in their normal relation with special reference to (*a*) abnormalities in size, form, and shape; (*b*) presence of unerupted or impacted teeth; (*c*) presence of supernumerary, or congenital absence of, teeth. These items have a direct bearing on the health of the mouth, as variation in the arch form, position and alinement of teeth can be reflected in the presence of caries and involvement of gingival tissues.

8. Large pathologic areas and their boundaries. It is best that these areas be checked with extra-oral plates in order that the full extent of tissue destruction can be determined.

As a precautionary measure in roentgenographic interpretation, it is well to remember that the mental foramen, anterior and posterior palatine foramina, maxillary sinus, inferior dental canal, the external oblique line of the mandible and sclerotic bone areas have often been mistaken for pathologic areas.

VITALITY AND MOBILITY TESTS

As previously stated, the roentgenogram does not show pathologic changes in the early stages of disease of the pulp; therefore, it is necessary to resort to some reliable means of getting this information. The electric pulp test, wherein a current of low voltage is passed through the tooth, has been found to be quite reliable in determining the vitality of the pulp. All teeth should be tested as a routine procedure, but before applying the test, the normal irritation point, or the point at which the tooth responds to electric stimulus for that particular patient, should be determined. This can be done on several teeth in order to find the average current strength to which the teeth respond. With the teeth dry and free from moisture, the electric pulp test can be made, and the resulting response indicated by a plus or minus sign on the chart. The electric pulp test should not be relied on too fully in multirooted teeth, as one canal may be putrescent, with the other canals vital.

Transillumination is an important adjunct to vitality tests, and should be employed when necessary. By this method, a tooth with a vital pulp will appear transluscent and pink, while a pulpless tooth often will appear opaque and dark.

Mobility tests of the teeth are important in that they determine the fitness of the teeth for restorative work.

EXPLORATORY EXAMINATION

In making an exploratory examination of the teeth, observations should be made on variations in form and contour of the teeth; the presence of caries not previously noted in the roentgen-ray examination; contact points; the condition of fillings and restorations, and the presence of calcific deposits. It is advisable, before the study of occlusion and the planning of restorative work is attempted, to eliminate all doubtful teeth and pathologic areas, and institute prophylactic measures to free the mouth of calcific deposits and débris.

STUDY OF OCCLUSION

As it has often been stated, occlusion forms the basis of all dental practice, as masticating efficiency depends on proper occlusion and functioning of the teeth. Up to this point, enough information will have been gained about the condition of the teeth that a definite decision will have been made as to the teeth that will be retained and the teeth that are to be extracted. Study casts are very helpful, as they afford opportunity to study the lingual occlusion as well as the labial and buccal relations of the teeth. Each tooth that is to be retained should be carefully checked, especially if it is to serve as a bridge abutment or as an anchorage for a partial denture or other removable appliance. Investigation should be made as to the existence of occlusal trauma, and corrective measures instituted. Study casts can also be of value in charting proposed restorations of the mouth.

GENERAL PLAN OF RESTORATIVE WORK

A builder who would attempt to erect a house without the aid of an architect's plans would not be in any more distress than is the dentist who would attempt to restore the mouth to normal conditions without having a prearranged plan of procedure to follow. Too often, the mistake is made of fixing one tooth and then another, without much thought as to what the general outcome will be, so that, in the end, little of real value has been done for the patient; whereas, if a definite plan had been evolved before starting the work, each operation planned could be carried out with a definite object in view, and with an end-result that would be gratifying to both patient and dentist. Therefore, it is apparent that, in a general plan of restorative work of the mouth, the all important factor is the consideration of the oral cavity and the normal complement of teeth as a whole, including the physiologic relation of one tooth to another, without an attempt to solve the problem of restorative work by treating the individual tooth as a unit.

DISCUSSION

George W. Christiansen, Detroit, Mich.: The need for a systematic method of mouth survey is indeed urgent. This is also applicable to routine examination of the roentgenogram. By following a definite method each time a film is studied, we frequently see important details, which might be missed. Beginning at the incisal or occlusal edge, we should observe the proximal surfaces, cervix, pulp chamber, canals, outline of root, peridental membrane and lamella, interproximal soft tissues, bony septum and, finally, the cancellous bone. Failure to find caries or deep restorations which might cause involvement of pulp will usually prevent jumping at conclusions regarding apical disease. Such are often suggested by proximity of shadows of the foramina and antrums. Some cysts cause a decrease in the size and, occasionally, almost

complete obliteration of the antrum. Roentgenograms of such a condition may suggest a multicelled antrum. Because of difficulty as to differentiation, good teeth are sometimes lost. If films taken from different angles, and other means, fail, at least two procedures remain: (1) insertion of a small needle through the antral wall to attempt aspiration of cystic fluid; (2) puncture of the naso-antral wall and irrigation through this. Dr. Edwards has admonished the dentist to learn the oral manifestations of syphilis and malignancy. Detection of the former is desirable for his own protection principally. Recognizing malignancy of the mouth and tongue early enough will save many thousands of lives annually. We must constantly remember that chronic fissures and ulcers, leukoplakia and indurated areas are essentially precancerous soil. Glandular metastases develop rapidly and an incurable condition is present in an inconceivably short time. Finally, in routine examination of the mouth, let us look on it as a vastly important portion of the body as a whole, not an entity.

Allan Scott Wolfe, Washington, D. C.: No man should attempt oral diagnosis without having had the privileges and the setbacks that arise in the general practice of dentistry. I had fourteen years of this before I learned to eliminate mouth infections, and it has been my greatest asset. It is absolutely necessary to have some medical background and to be able to see the mouth through the eyes of the physician. This does not necessarily mean that you are to follow his ideas, but that you are to attempt to make him follow yours, and only complete understanding of medical data can bring about this result. I do not accept diagnosis cases from the dental practitioner, my work coming from the medical man, the patient being incidental and the finished report being returned to the internist. The procedure that Dr. Edwards has given you in checking up on the oral cavity is so well given that it needs no reiteration on my part. As the case comes from the physician and the various examinations are made, we ask the physician to give us the result of his test, that is to say: urinalysis and blood, cardiac and various other tests which go to make up the physical examination, and, in return, we send him our set of roentgen-ray films, with our findings. In cases of lack of systemic resistance or morbid conditions of any kind, complete elimination is made; that is to say, the extraction of all pulpless teeth and teeth so badly affected with pyorrhea that they can not be saved and all residuals. Before this is done, treatment of the mouth is given, by the Vastine method. The case is put in the hands of a hygienist for restoration of gum conditions. If the patient has a dental practitioner, he is sent back with written advice as to how the work of restoration should be done. You can readily see that the dental practitioner as a rule is no friend of mine, after receiving this report. I am firmly convinced that it is only by group methods that proper elimination of oral infections and proper restoration can be given the patient who desires the best, which, by the way, is not always the most expensive, as, in my opinion, the partial plate, greatly glorified, is giving aid to thousands of people who have been burdened with fixed and removable bridgework. I wish to lay a special emphasis on the oral cavity of the average man, who has in his mouth what we should term premalignancy. Without some medical help or medical background, we are not able to give this man the best of treatment, as most of these conditions are the result of faulty metabolism and cannot be treated by local methods alone. Here again, I agree with Dr. Edwards that, as long as this is a premalignancy, we can do many things for the patient, but when it becomes a neoplasm, our work is diagnostic and preventive rather than curative. When all traces of focal infection have been removed from the mouth and the soft tissues are in perfect condition, the case is turned over to the prosthodontist; but it should not leave the hands of the oral surgeon until a definite cure has been made, that is to say, there has been complete healing of all wounds, with restoration of the mouth epithelium. There is a crying need for just the technic given by Dr. Edwards in the handling of cases of systemic infection and all cases of lowered resistance.

George R. Warner, Denver, Colo.: I like Dr. Edwards' definite plan of examination. If we have things down in 1-2-3 order, it is easy to carry them out, and the practitioner is going to do the things which are the easiest. The chart must be relatively simple. For instance, if we were to attempt to use the chart supplied by the Veterans Bureau, we would be sure to fail, because it involves too much work and time. It is not enough to make a diagnosis, and to tell the patient what the trouble is. The patient wishes to know how he is to get out of

his difficulty. He wishes to know the plan of work, and incidentally to have some idea of the cost involved. I think those two things should be considered in conjunction with the examination and the patient should be given an opportunity to consider them. Dr. Edwards brings out in his paper that transillumination acts as a differential diagnosis between vital and pulpless teeth. I tested transillumination for a number of years and finally dropped it as of no great value. Transillumination for pneumatic cavities of the head is undoubtedly valuable. Dr. Edwards said that the roentgenogram does not reveal early pathologic change in the pulp. I feel that it does. In those cases of vital infected pulp, we are frequently able to make the final diagnosis by means of the roentgenogram. We have conflicting reports from the use of cold or heat or the electric test, and the condition can frequently be determined by the changes in the periapical region or the appearance of the pulp. We also have those early calcific changes in the pulp which the roentgenogram will frequently show, as also in the case of periodontoclasia. Rarefying pericementitis fibrosa (Box) can be recognized by the roentgenogram long before it can be determined by the clinical examination. I have had quite a long list of cases of beginning periodontoclasia in children of the "teen" age which could be diagnosed only by the roentgenogram. The clinical examination showed perfectly healthy mouths, free from calcific deposits or any other evidence of pathologic change.

Edouard M. Hall, Kansas City, Mo.: I should like to add a word against believing too much in transillumination. Some of the literature sent to our offices would have us believe that we can even determine the type or species of bacterial invasion by the differences in transillumination shadows. There are many different conditions to be considered in making routine mouth examinations. One of these is the fact that the patient does not want to be, and should not be, exploited. For instance, the patient has a full cover gold crown fitting well under the free margin of the gum. The patient has had no discomfort of any kind with this tooth; there are no local symptoms, and the roentgenogram is negative; that is, shows no periapical disease and no evidence of the tooth's being pulpless, with root-canal filling, etc. Naturally, the patient is not anxious to have us remove the crown just to be doing something. Now, if transillumination gives us a definite shadow from the roots of this tooth as compared with an analogous tooth having a known vital pulp, we will have evidence justifying the removal of the crown and the application of the electric test. In such cases as those described above, transillumination is valuable, and when we get a definite shadow from such teeth, due to organic discoloration, we are generally safe in stating that the pulp is dead. I agree with the two speakers who have warned against depending too much on transillumination; yet, in cases such as those described above, it is a valuable aid and of course in a study of the sinuses, it is almost indispensable.

Dr. Edwards (closing): I am interested in the first point brought up by Dr. Warner with regard to the extent of the chart which should be employed for recording clinical and roentgenographic findings. Often these charts are much too extensive. We try sometimes to embrace everything; whereas, these charts should be shortened and contain only such items as are of value in helping the dentist to gain information relative to the patient's mouth or the general health. It was with a degree of temerity that I injected the subject of transillumination. As you will particularly note, I said that it will often show a shadow—not always. I mean to infer that transillumination is of value in some cases, but it cannot be relied on entirely. In my own hands, it is found to be wanting and is not thoroughly reliable. I believe it an agent on which to depend for help in determining the vitality of the tooth. It has not been my good fortune to be able to discover, in a roentgenogram, the early stages of disease of the dental pulp. Perhaps I was not clear enough about this particular thing in my paper. In the earlier stages, there are not tissue changes of the harder structures of the tooth, or of the periapical area; consequently, those conditions cannot be determined by the roentgenogram. True enough, after these pathologic processes are well under way and tissue destruction has occurred, they can be easily recognized by the aid of the roentgenogram.

MOVEMENTS OF THE MANDIBLE NOT PROVIDED FOR IN PRESENT-DAY ARTICULATORS*

By A. H. BROWN, D. D. S., Denver, Colo.

I HOPE that my message will be heard by a goodly number of denture prosthetists and that they will bring all the constructive criticism possible to bear on the points discussed. It has been my purpose to eliminate completely technical terms and phraseology so that all that I say may be readily understood by the general practitioner. I honor the man who is able, as I am not, to go into the meetings of any section of our Association and understand what is going on and take part in the discussions. He is the man who is doing 70 per cent of the dentistry of the country, who works for the great middle class and who should be able to construct the high class of dentures his clientele have the right to expect from him.

It seems to me that the whole subject of denture construction was never in a more chaotic state than now. With the late arraignment by one of our most prominent prosthetists of nearly everything we have been taught to revere, especially interdigitating cusps or, in fact, any cusps at all; with another man of prominence in the denture field decrying the use of any of the present-day articulators, the face-bow or the usual kind of check-bites, and with others of greater or lesser prominence taking positions anywhere between pessimism and optimism, a mental picture is brought up of the blind leading the blind. Let us not be too deeply impressed by what alarmists may say, remembering that "it is darkest just before the dawn."

My subject, movements of the mandible not provided for in present-day articulators, might be construed as opening for discussion the whole subject of articulators, though, in reality, I shall refer to them but briefly. Instruments depending on such unstable material as compound to represent the fossae in which metal condyles function, and so-called "three dimension" and "functional position" articulators, those of the tripod variety, having no condylar axes, I shall not discuss further than to say that those of the former type would not be dependable because the material composing the fossae is too soft to withstand the wear brought upon it, and also because there are no guides controlling the condylar movements; and those of the tripod variety would be unsatisfactory because of the fact that they have to be readjusted to each functional position. They also fail to provide an area in which the condyles may have free horizontal movement as is the case in the living subject when the mandible is in partially protruded position. I desire an instrument with which I can arrange teeth on both sides simultaneously, checking back frequently to avoid interference with articu-

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lation already secured. The advocated "tentative" arrangement of teeth, with but two functional positions represented in the articulator, does not appeal to me as good mechanics or as a conservation of time. The fact that an articulator has not yet been brought forth which meets all requirements need not discourage any one. The world is young and human ingenuity is of a higher order than ever before, and for any one to presume to say what will or will not be done in the future is undertaking a contract that is surely big enough. We require an articulator, preferably of the hinge type, which will faithfully reproduce the essential movements of the mandible, or, as Mr. Hanau says, "have movements equal to those of the mandible."

Much time has been spent in attempting to reconcile the movements of the mandible to geometric formulas. Its movements have been likened to those of an equilateral triangle in which two of the angles represent the condyles and the other the incisal point; and the normal arrangement of tooth cusps in the living subject has been shown to conform, in a general way, to the surface of a sphere. These hypotheses are illuminating and their originators are deserving of our highest respect and gratitude. It is my conviction, however, that the fact that mandibular movements do conform in a measure to any of these theories is merely coincidental and forms no part of a divine plan. While I cannot accept the spherical theory *per se*, I have abundant evidence that mandibular movements are spherical, though the size of the sphere represented varies in individual cases, and frequently the surfaces of two spheres are represented in a single case. Further, I do not think extension of the spherical lines backward would cause them to pass through the condyles in very many cases. In persons in whom the condyle paths were nearly horizontal, the cusps of the teeth would lie on the surface of a sphere much larger than in those in which the condyle paths were steeper. Spheres most nearly adaptable to the occlusal planes of different natural mandibular dentures might vary in size from 6 to 60 inches. I do not know how much.

For about fourteen years, I have been trying to duplicate the movements of the mandible. In that time, I have spent hundreds of hours and some money in my investigations, have made and discarded, in part or wholly, several machines, until, in 1926, I showed informally an articulating device in which mandibular movements are registered in a plastic material. The plastic material is replaced by Mellott's metal and becomes the fossae of the articulating mechanism. No face-bow nor checkbites are used. It is, however, too complicated for practical use. I believe this to be one of the most nearly perfect instruments ever devised for registering mandibular movements, and it is on evidence furnished by it that I base my conclusions and claim authority for some of the statements that I shall make.

The mandible represents a lever of the third class. It has no support on hard tissue but is pendent from the osseous structure above it by several ligaments and muscles. Its movements are many and varied. Dr. Gysi says, "The more we study the movements of the mandible, the more shall we be astonished at their infinite variety." And again he says, "The problem of articulation will not be solved until the movements (mandibular) can be exactly imitated, not only for the average normal case, but also for each individual one."

Condyle paths are real and quite definite. In the partially protruded position of the mandible, there is some latitude of movement of the condyles in their respective fossae, they being capable of horizontal movement in all directions within narrow limits, though never losing contact with the menisci.

The menisci, also called the interarticular fibrocartilages and the interarticular disks, are concavoconvex disks of a cartilaginous nature, functioning between the condyles and the glenoid fossae. Their centers are deeply depressed, forming sockets in which the condyles rest. Their inner and anterior edges are thick as compared with their outer and posterior edges. They are resilient and compressible, and so two movements of the mandible are allowed, which, I think, no articulator reproduces or imitates. The first of these might be called the superretrusive movement. It is the movement of the condyles backward and downward from their normal centric positions.

When the mandible is in centric relation, the condyles are in their most retruded rest, or unstrained, positions in the fossae, but by greater effort, or straining, the condyles can be forced to positions slightly backward and downward, describing the superretrusive movement. As stated, the movement is made possible by the compressibility of the tissues of the glenoid fossae. It is a strained position, is not a normal functional position and so is not one in which we as denture prosthetists are greatly interested.

The second movement made possible by the resiliency or compressibility of the interarticular tissues is of considerable importance to us. It is known as the intrusive movement, a movement of the condyle of either side upward from its rest position; and results from the contraction of the powerful temporal and masseter muscles, which drives the condyles bodily into the slightly yielding menisci. It is frequently associated with a slight forward or backward component. The range of movement is short, probably never exceeding one thirty-second inch, though quite sufficient to change the position of applied force on dentures. While it would be a comparatively easy matter to incorporate this movement in an adaptable articulator, I do not know that it has ever been done; nor would it seem to be necessary. It would necessitate making two sets of checkbites, one set under zero pressure and the other under biting stress. I believe that this movement can be accounted for in a more simple and an equally effective manner, by making provision for it by carrying out the whole process of denture construction under functional conditions. This means that impressions and checkbites must be made under closed-mouth conditions, and, as nearly as possible, under unvarying pressure throughout. Incidentally, following this technic nullifies, to a large extent, the anterior component of force. If impressions and checkbites are made under working conditions, we need have little concern about any slight variation of articulation taking place under zero pressure. Functional efficiency is to be our goal, and it can be reached through a careful technic, perhaps, with even more certainty than would be possible with an articulator made to reproduce the intrusive movement, since, in the latter case, as stated, we would have to contend with inaccuracies inherent in two sets of checkbites.

Most articulators are made with an upper and a lower bow, the lower bow turning on a rotation axis which is above

and posterior to the plane of occlusion. This is known as the hinge type. I believe this basic principle to be correct and feel sure that an articulator designed on this plan will be developed with a sufficiently large range of adjustments to make it adaptable to all normal cases.

The lateral condylar movement, also known as the Bennett movement, the lateral aberration and the lateral deviation, is the lateral movement of the condyle of the working side from its centric relation position, when the condyle of the opposite side moves forward, downward and inward. The movement is seldom along the line of the rotation axis, but is associated with an upward inclination and frequently further complicated by a slight backward or forward component. I have never observed the direction to be downward from the horizontal line though I am unable to say that it never occurs. An adaptable instrument should include an adjustment for such an eventuality. The movement seems to be the result of the contraction of the internal pterygoid muscle of the balancing side, forcing the mandible bodily toward the working side. The extent of the movement has been described by Dr. Frahm as being as great as 5 mm., and this estimate seems probable in extreme cases, as I have seen it slightly in excess of 3 mm., with limited facilities for observation. The movement seems to occur near the end of the lateral sweep of the mandible, and not gradually through the whole of the lateral mandibular excursion as might be expected. As stated, the principle movement is outward, but it may be complicated by deviations in any direction from the line of the intercondylar axis.

All of these lateral movements, together with the intrusive movement already spoken of, affect the position of the rotation point of the condyle of the working side and seem to introduce so many complications as to make the exact location of that point impossible by any means now at our command. However, with a fully adaptable articulator, the location of the rotation point would be unnecessary as the instrument would duplicate the movements.

My experiments have seemed to indicate that the lateral, or outward-upward movement of the condyle in the glenoid fossa of the working side, is somewhat analogous to the inward-downward movement of the condyle of the balancing side; that is, the surface of a sphere that would correspond to the downward-inward movement of the condyle of the balancing side would, if continued to the opposite side, in some cases, also represent the outward-upward direction of the condyle of that side. Were these compensating movements proved, it would not follow that an instrument built on the spherical theory would be reliable, even if workable oscillation points could be established. The size of the sphere or spheres would not be constant and the instrument would not provide for the forward, backward or downward deviation in direction of movement of the condyle of the working side from the line of the intercondylar axis. I doubt if one oscillation point could be found that would account for all of these complicated movements even in the most perfect anatomic case. Some articulators are partially adaptable to these movements, while others are made so loose in their articulated parts as to permit seating of the casts in the checkbites; but as they provide no guides for reproducing the positions after the checkbites are removed, they are practically worthless. An articulator, to be wholly acceptable, must be sufficiently adaptable to permit

seating casts in checkbites without interference, and to duplicate a lateral movement of the condyle of the working side of at least 3 mm., together with whatever deviations may be indicated by the checkbites. It must provide an adjustable condyle path of greater inclination for lateral excursion of the mandible than for the protrusive movement; the condyle members must be definitely guided from centric relation to and from all functional positions, and, after the adjustments are made, they must not be disturbed. Also an area must be provided forward of centric relation in which the condyles may have free horizontal movement to a limited extent. The tripod variety of articulator might be expected to best meet some of these requirements.

While these movements are taking place in the fossa of the working side, an important movement, which, as far as I know, has never been described, is being made by the condyle of the balancing side. It is the movement downward, forward and inward of the condyle of the balancing side in lateral excursion of the mandible, at a greater degree of inclination than it takes when moving forward and downward in the protrusive movement of the mandible. A machine built on the spherical plan would, to a limited extent, permit movement in this direction, but there would be nothing peculiar or individual in the movements, and there would be no definite means for inducing them. Only the tripod instrument would be fully adaptable in this respect.

The glenoid fossa is somewhat concave, with the concavity facing downward, outward and backward, so, as the condyle of the balancing side moves downward, forward and inward, it would necessarily take a somewhat greater angle of descent than it would in the direct protrusive movement because of the greater curvature of the inner wall of the fossa. This, however, fails to account for so great a difference in the inclination of condyle paths as is found associated with the two movements.

In conversation some time ago, a prominent denture prosthetist made a point of the fact that the condyle of the balancing side was subject to peculiar variations from its supposed normal movements as it passed downward, forward and inward during lateral excursion of the mandible. These peculiarities he ascribed to malformed condyle necks and irregularities in the shape of the condyles themselves. I recognize the effect, though I believe the movement to be, in most cases, entirely physiologic and normal. Contrary to the popular belief that the condyles remain in their respective concavities in the interarticular fibrocartilages at all times; that, therefore, in all excursional movements of the mandible, the condyles must be accompanied by the interarticular disks; that the disks slide along the under surface of the temporal bones in their respective glenoid fossae in all movements of the mandible, and that the only movement taking place between the condyles and the interarticular disks or menisci is that of rotation when the mandible is raised or lowered, I am of the opinion that the menisci have a double function. In direct protrusive movement of the mandible, the condyles and disks move forward as a unit, maintaining their relations; but, in lateral movements of the mandible, the disk of the balancing side remains in its position in the glenoid fossa, allowing the condyle to slide along its under surface. As stated, the disks are thicker near their inner and anterior edges than in the depressions in which the condyles rest; therefore, as the condyle of the balancing

side moves forward on to the thicker part of the disk, it must take a more rapid descent than would be the case if the disk moved forward with the condyle. This seems to account logically for the difference in inclination of the condyle paths in direct protrusive and in lateral, mandibular movements, and, while only theoretical and undemonstrable, seems probable. This peculiarity of action of the interarticular disks can be accounted for by assuming that only the internal pterygoid muscle of the balancing side functions in lateral mandibular movement, or, as is probable, it acts in conjunction with the lower portion of the external pterygoid of the same side. The upper portion of the external pterygoid muscle attaches to the neck of the condyle and also to the meniscus, while the lower portion attaches to the neck only. As is the case with most fan-shaped muscles, the external pterygoid is probably a differential muscle, that is, each portion is capable of functioning independently of the other. If, then, only the lower portion of the external pterygoid muscle acted together with the internal pterygoid in producing lateral mandibular movement, the meniscus would remain stationary because there would be no traction on it and the condyle, being drawn forward on the thick rim of the meniscus, would be forced to take a steeper angle of descent than would be the case if the condyle and meniscus moved forward together toward the eminentia articularis along the more nearly horizontal floor of the glenoid fossa.

I do not know that these differences of condyle path inclinations have ever been previously discussed; nor do I know of any hinge-type articulator which makes adequate provision for them.

I believe that the lateral movement of the mandible is most important, as affecting functional efficiency of artificial dentures, and that our inability to duplicate its peculiarities in an adaptable articulator has given rise to our greatest trouble in stabilizing dentures and preventing trauma under them.

Well-balanced dentures, constructed with proper regard for direction of applied force, should be firmer in the mouth of the wearer after three months' use than when inserted. Balance, stability and articulation, prime requisites of good dentures, are dependent on a more completely adaptable articulator than is now at our disposal.

I find this in the writings of Dr. Gillis. "We have never seen a patient presenting soft, flabby ridges unless he also presented a history of having worn badly articulated dentures." He then adds, "It would be interesting indeed to see a case of soft, flabby ridges not so associated." Dr. Frahm has pointed out that "work done on articulators built to the law of averages is average and not individual." As quoted, Dr. Gysi says articulation depends on exact imitation of mandibular movements.

From George P. Phillips we have: "Taken functionally, the temporomandibular joint assumes the nature of a complex mechanism, of which the precise manner of operation cannot be ascertained or determined by assumption, or plausible theories, or even by the application of geometric laws, which, admittedly, form the basis of all mechanics dealing with movement, but only through close scrutiny and faithful reproduction of the movements it produces."

Dr. Stansbery quotes from a paper read by Russell W. Tench in 1925. "The problem of mandibular movement in denture prosthesis has been so involved in geometric hypotheses that it has become totally unintelligible." And he adds,

"This, unfortunately, was true even at that time, and, since then, more geometric intricacies have been added." Dr. Tench says, "When an instrument is adjusted, it should produce only the movements of the patient for which it is being used, and no other movements."

CONCLUSIONS

Instruments in which condyle representatives move in depressions in modeling compound are unsatisfactory in that they depend on too soft a material to represent the articular fossae, and the condylar movements are not definitely guided from one position to another.

Tripod, so-called, functional position or three-dimension articulators are unsatisfactory because of the fact that they must be readjusted for the reproduction of each functional position or movement, introducing inaccuracies and requiring much time. They also fail to provide an area, forward of centric relation, in which the condyles may have slight movement laterally.

No articulator built on the spherical theory is sufficiently adaptable to reproduce the peculiar movements of the mandible, because there is no central point, or oscillation center, from which all occlusal contacts are, or should be, equidistant.

Theories and hypotheses of the fundamental laws governing the movements of the mandible are illuminating and interesting but fail to show a closer relationship than that of coincidence in their similarity of results obtained.

Condyle paths are definite except while both condyles are forward of their centric positions, at which time there is some free latitude of movement in any horizontal direction. An adaptable instrument must permit of this movement.

The intrusive movement of the condyles is best provided for by making impressions and checkbites under pressure, simulating functional masticatory conditions.

The lateral condylar movement, which is, in denture prosthesis, the most important as well as the most complicated taking place in the glenoid fossa of the working side, leads to imperfect articulation of artificial dentures unless duplicated in the articulator.

Peculiarities accompanying lateral mandibular movement must be exactly imitated or equaled in the mechanism of an adaptable instrument.

An adaptable articulator must present, in both articular areas, an adjustable condyle-path mechanism differing for direct and lateral protrusions of the lower bow from centric relation. Paths of condylar movement forward and laterally only, even though definite, are not sufficient.

Some of the peculiarities noted in direction of movement of the condyle of the balancing side probably arise from the fact that the meniscus and condyle move as a unit in direct forward protrusion of the mandible at a relatively small angle of inclination; while, in lateral movement of the mandible, the condyle of the balancing side moves forward along the under surface of the meniscus at a greater angle of inclination because of the thick inner and anterior edge of the meniscus.

Since it seems impossible by any means now at our command to locate accurately the rotation point of the condyle of the working side, we must depend on an instrument, preferably of the hinge type, which will faithfully reproduce all of the functional positions of the mandible as indicated by the checkbites.

Finally, an adaptable instrument must permit the free seating of casts in check-

bites without interference, after which, the adjustable guides of the articular may be brought into contact with the condyle members and secured in position throughout the process of arrangement of the teeth.

DISCUSSION

Robert R. Gillis, Hammond, Ind.: Dr. Brown has made a sincere effort to advance denture prosthesis through bettering his understanding of mandibular movements. He apparently has spent no little time in clinical observation and experimentation. From several of his statements, however, I am led to believe that he is not familiar with prosthetic literature of the past and the reported findings of his predecessors in this line of investigation. Experience leading to unsatisfactory results has caused him to realize that there is much yet to be learned about the once baffling problem of mandibular movements. I would suggest that familiarity with nomenclature employed by earlier writers might prompt the use of more proper terms in this presentation. I believe that Dr. Brown has the right conception on some points, but he has failed to convey his meaning concisely to the reader. "Centric relation" is now understood by all as the accepted reference position of the condyle heads to which the direction and magnitude of their excursions are referred; giving consideration also to jaw separation. Dr. Brown mentions a "superretrusive" movement. "Super" means beyond or above. I can conceive of a retrusive movement which is due to strain or load upon the tissues in the temporomandibular joint and under each denture, but I cannot conceive of a movement above or beyond that retrusive movement, unless it be the result of and accompanied by severe trauma of the supporting parts. I deem the use of the term "superretrusive" incorrect. I beg to differ also when he says, "This movement made possible by resiliency of the tissues . . . is not one in which we as denture prosthetists are greatly interested." There are several other factors besides resiliency of the interarticular tissues which enter into this problem of resiliency, and I would refer to an article in *Dental Engineering* by Hanau to bring home to you the full import of this phase of the denture prosthetist's problem, all of which factors Hanau has condensed into the single word "realeff."[2] Dr. Brown is interpreted as confining himself to the resiliency of the tissues of the temporomandibular joint. While this one element of resiliency is well worthy of attention, we must not overlook the resiliency of the denture-bearing tissues in our calculations and registrations. Those who have labored to devise articulators will find little comfort in Dr. Brown's paper, for none of the devices known to him today seem to meet his requirements fully. The kinoscopes, model C, and particularly models E and F, must be unknown to him; otherwise, he could not have arrived at such a conclusion. These instruments have been designed to silence the argument that instruments cannot be constructed to conform to exaggerated theoretical demands. Model C is a practical instrument for searching and exacting requirements, while models E and F have been developed beyond the requirements of practical denture construction. When we consider the many component movements of the human mandible, and that, out of only eight of these components, there are 441,624,960 possible combinations, the problem does appear quite impossible. Please bear in mind that the adjustment of any articulator registers much more than mere condylar movement for the case. Bear in mind, too, that mounting the maxillary and mandibular casts in centric relation upon any articulator is merely registering the denture space. The subsequent setting of the articulator parts that become guides for articulator movements constitutes a registration of the patient's mandibular movements not only as to magnitude and direction, but also as to resiliency of denture bearing and condylar tissues, viscosity of the oral secretions, skid of denture bases on ridges and all other factors concerned. We thus register movements, and more—a resultant of all factors. Hence, the guides allow production of articulator movements that are equivalent to or the resultant of all factors of guidance taken from the mouth. Dentists have erred in interpreting the movements of their articulators by accepting them as duplicating the exact movements of the patient's condyles. The parts of the articulator that may be called "condylar parts" seldom, if ever, move just as the

2. Hanau, R. L.: Occlusal Changes in Centric Relation, J. A. D. A., 16:1903 (Oct.) 1929.

patient's condyles do. Why should we feel much concern for any one of those component movements, even for any such will-o'-the-wisp as a superrestrusive movement when we have instruments on which we can register equivalent guides for all mandibular guidances? Failures of dentures today should not be charged to lack of amply adjustable articulators. When dentists can use available articulators with full intelligence, results will be more satisfactory. Articulators today are developed beyond the understanding of our dentists. We do not need more articulators as much as we need more dentists. Dr. Brown seems to accept the "tripod" articulator as most nearly meeting his demands for a fully adjustable articulator. It may be admitted that such a device will register the end position of any mandibular movement from the accepted centric relation; but enthusiasm chills when we find that the articulator path between the two positions is not correct. Such a device is useful "to reproduce positional or fixed relations of the mandible, according to checkbites, but not its movement."[3] As to the anatomy of the temporomandibular joint and the relative influence and functions of the pterygoid muscles, I would refer the reader to articles by H. J. Prentiss[4]. As to the difference between the anteroposterior path of the condyle and the lateral path of the condyle, we would refer to Dr. Gysi[5]; and Walker observed the effect of this difference, but uses other nomenclature in his article.[6] Each generation of writers, we might almost say each decade, produces repetitions of much that has gone before. This is not to be discouraged. It is bound to happen since, until very recently, our dental literature has had no ample index to which an investigator might turn to learn what his predecessors have recorded. Dr. Brown is to be commended for the effort he has put into solving his vexing problem. His enthusiasm, we hope, will be augmented by others whom he will interest in it. Constant effort along the line will probably lead to the conclusion that it is quite unnecessary to measure the exact magnitude of each factor, if we but incorporate the resultant feature in our denture technic.

Rudolph L. Hanau, Buffalo, N. Y.: As far as the intrusive and extrusive movements are concerned, Dr. Brown is partially correct and so is Dr. Clapp, but they are talking about a different issue. I do not think that Dr. Brown intended to infer that the meniscus is compressible, but only, if I understand correctly, that the condyle head may rest upon a thinner or thicker part of the meniscus over the same position of the condyle path. Resting on the thick part would be the termination of an extrusive movement, and when it returns from that high point to a lower point of the meniscus over the same position of the glenoid fossa, the movement is referred to as intrusive. As far as centric relation is concerned, let us understand that centric relation is the accepted position of reference as was defined by Dr. Gillis. If Dr. Clapp quotes me as saying or as having stated that Dr. Heerman's denture is in centric occlusion, he is perfectly correct, but I added that his denture occluded in centric occlusion associated with a protruded relation of the jaws. That is pretty plain and concise language and should not be misunderstood. It means, expressed in other words, that the jaw was in a protruded relation and that the patient could close in centric occlusion associated with protruded relation. His position in protruded relation was an acquired position, accepted by many a patient after they have endured all stages from discomfort to torture. In the end, patients may accept a position of minimum discomfort. If that position of minimum discomfort is seemingly acceptable, the patient may have a generous impulse or be induced otherwise to pay his bill. I understand that, in the mind of many dentists, this settles the whole denture question. It does not settle the issue for an investigator like myself who, incidentally, is not a dentist and fortunately is trained to aim for exacting results even though they sometimes do not appear so practical as some like to see them. Dr. Gysi once mentioned that what some would like to have is a slot machine where you can put a quarter into the slot and receive a two-hundred-dollar-paid-

3. Hall, R. E.: Full Denture Construction, J. A. D. A., 16:1164 (July) 1929.

4. Prentiss, H. J.: Regional Anatomy, Emphasizing Mandibular Movements with Specific Reference to Full Denture Construction, J. A. D. A., 10:1085 (Dec.) 1923.

5. Gysi, Alfred: Dent. cosmos, 52:1 (Jan.), 148 (Feb.), 268 (March), 403 (April) 1910.

6. Walker, W. E.: Dent. cosmos, 38:34 (Jan.) 1896.

for-denture. That would be wonderful—a business corner in Schlaraffia.

Dr. Brown (closing): I may be wrong, but I think there is no central relation. We should say centric relation and central occlusion. I may be unscientific in some of my terminology, but I have tried to make it correct; if it is not fully explanatory, it is not, I think, incorrect. If the mandible is protruded to the furthest position and we bring it back to the centric relation position, which I have described as the furthest retruded rest or unstrained position, we are making a retrusive motion of the mandible. When it is in the centric relation position, it can, by straining or a greater effort, be forced to a position slightly backward of the centric relation position, which I say might be called the superretrusive position. I am not trying to establish new nomenclature, but I want to differentiate between the movement of the mandible that takes place when it slides from the protruded position to centric relation, and that which takes place when it is forced from centric relation, under undue pressure, slightly backward and probably slightly downward from that position. Now this word "realeff." I think that if we should call for a show of hands of those who understand what "realeff" means, we would not get a unanimous vote. "Resiliency and like effect" may mean something to you, but I cannot make it mean anything tangible to me, so I have refrained from the use of the term. Realeff, you might say, is the arrangement of the initials of those words, "resiliency and like effect." I do not know whether Dr. Schlosser is the originator of the term or not, but he uses it quite a good deal. Dr. Gillis said something about Dr. Prentiss' work. I have talked to Dr. Prentiss and I know that he thinks the condyle and the meniscus never separate, that they always move as a unit, and it may be that he is right. What I have found or think I have found is entirely theoretical and undemonstrable. I cannot demonstrate it, but I am trying to find out why this condyle moves in a way that we think it should not move, and if its moving upon the thicker anterior margin of the disk will explain that, it is a good theory. Whether it is true or not makes no difference. We have to have an articulator that will reproduce or imitate those movements. I know nothing about this case of Dr. Heerman's, but there pathologic conditions are talked of. I tried to keep away from that entirely. I endeavored to discuss normal conditions, which we have plenty of trouble with without going into pathology. I do not say "condyle head." I think that is incorrect.

I do not say that the condyle moves upward a thirty-second inch in its intrusive movement. I say, perhaps never more than one thirty-second inch. It can move one-millionth inch and still be within all I said. I do not think that it moves one thirty-second inch in many cases; I think that it very seldom does. Dr. Clapp, I think it was, said that there were sometimes downward movements of the condyle instead of an upward movement, when the muscles were contracted. I have tried in dissections and otherwise, to determine some way that there might be some slight pressure downward upon the condyles, but I cannot find any muscles the contraction of which would influence the condyle in that way. The temporal and masseter muscles are well forward of the condyle, and the third molar teeth are about the middle of the resultant force of those two muscles, so even if we are biting on the very posterior margin of the third molar, we are only biting directly in the center of the line of direction of those muscles, and I can see nothing that would throw those condyles downward. This is not the first time that I have heard about this movement, but I have never had its existence proved to me. Probably, the number of unusual movements or combination of movements possible in the mandible is not overestimated as being several millions. As Mr. Hanau says, the point of minimum discomfort can very well be taken as the centric relation position. The glenoid fossae face downward, outward and backward. As the condyle fits into this position (illustrating) we can see that as it goes straight forward. It has one inclination. As it comes inward, downward and forward, it would have another inclination because of the greater inclination of the inner wall of the fossa. If, in addition to that, the meniscus stays permanently in the fossa and the condyle moves forward on the thick edge of it, we are not only getting that inclination but are getting this (illustrating). The condyle comes up on to the anterior rim or margin of the disk, the disk remaining in the fossa. This possibly is the case and, if so, it accounts for the peculiar movement that seems to take place in the fossa of the balancing side. I believe a comparison of the paper and the discussions will reveal that the differences are more apparent than real.

LESIONS OF THE DENTIN AND THEIR SIGNIFICANCE IN THE PRODUCTION OF DENTAL CARIES*

By E. W. FISH, M.D., Ch.B., L.D.S., London, England

FOR many years, the phenomenon of a translucent zone under caries has been regarded as an indication that the dentin under the floor of the cavity was alive and reacting.

There are some serious objections to this view. Apart from the overwhelming evidence that has been collected to show that injured dentin is dead, through to the junction of primary and secondary dentin, there are grave theoretical difficulties involved in supposing that a dentinal tubule can be open to the mouth at one end and alive at the other. A moment's consideration will show that this implies that the tubule may contain micro-organisms and a necrotic fibril in its peripheral part and living lymph and a live half fibril in the central part. It also implies that Tomes' fibril can be dead at one end and alive at the other. That is to say, the odontoblast of which it is a process is a half dead cell.

It further implies that the lymph[1] in the central end of the tubule is alive although the tubule is blocked and the lymph unable to circulate; and despite the fact that it is in contact with necrotic material which would diffuse into it, this lymph would have to remain alive.

Clearly, such a state of affairs could not exist, and even a translucent zone which might render conceivable such incongruous contents in the same tubule is by no means always present; in fact, more often than not, it is absent, and an explanation of its nature and existence when it does occur will be offered later on. Meanwhile, evidence will be produced that when a tubule is opened, either experimentally or from natural causes, giving access to mouth fluids, degeneration of the fibril occurs at once, and in a few weeks, the primary dentin is completely sealed off from the pulp by secondary dentin, its odontoblasts have disappeared, and it is dead.

It can easily be demonstrated that caries frequently starts in injured dentin (e. g., under a permeable lamella or fissure or in the exposed dentin at the neck of a tooth). Now, if this injured dentin can always be shown to be dead before caries sets in, caries would appear to be merely a process of fermentation and proteolysis akin to putrefaction.

Finally, the progress of this carious process will be traced through the dead tract of primary dentin and it will be seen to invade the secondary dentin. Immediately it does so, this tissue also dies

*From the John Hampton Hale Research Laboratory of the Royal Dental Hospital of London.

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*Read by E. D. Coolidge before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

1. Fish, E. W.: Circulation of Lymph in Dentin and Enamel, J.A.D.A. 14:804 (May) 1927.

and is sealed off from the pulp, and a tertiary deposit of dentin is laid down. This sequence may continue, and layer after layer of new dentin may be formed until the process breaks down and the pulp is exposed.

EXPERIMENTAL INJURY OF THE DENTIN

In order to appreciate the effect of an experimental injury on the dentin, such an injury, for instance, as that produced by cutting a cavity in it, it is necessary to recall the nature of the lymph movements in the dentinal tubules.

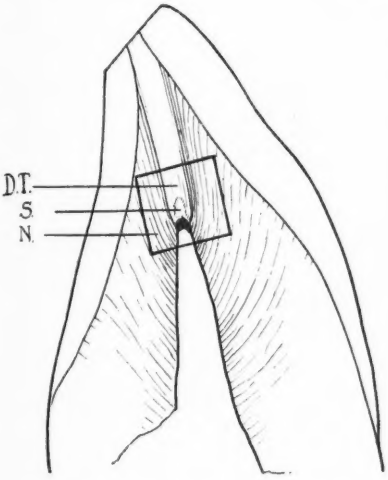

Fig. 1.—Ground section of human lower incisor, showing attrition. **Methyl blue was** introduced into the pulp tissue and sealed there for four weeks before grinding the section. The dye has diffused into all the uninjured tubules, but was unable to enter the tubules which were injured by attrition. These were sealed off from the pulp by secondary dentin and were therefore dead. *DT*, dead tract of primary dentin. *S*, secondary dentin; *N*, normal uninjured primary dentin. (Key to Figure 2.)

This has been fully described[2] and may be referred to as a mass movement of lymph along the tubules of an "ebb and flow" character. The movement takes place between the pulp and the "marginal lymph plexus," which acts as a reservoir and is formed by the anastomosing terminal branches of the tubules and the granular layer of Tomes.

It would appear inevitable that any peripheral injury of the dentin must interfere with the movements of this lymph and, by bringing a foreign body into contact with it, must cause it to coagulate. Moreover, the process of coagulation will spread until it reaches a point where there is a free collateral circulation, that is, at the pulp margin. This means degeneration of the fibril and ultimate death of the whole tract of dentin from the site of injury through to the pulp. That this does occur can be demonstrated in several ways. Each method depends on producing an experimental cavity in the tooth of a monkey or dog and waiting for a few weeks for the reaction to take place. The reaction will be completed in from eight to twelve weeks, and at the end of this time, the tooth is extracted and treated as follows: Solid methyl blue is put into the pulp through a hole drilled into the pulp chamber at some distance from the experimental lesion. The hole is then sealed up with wax and the tooth is placed in a 40 per cent solution of formaldehyd (2 per cent dilution) for a few weeks to keep it moist until the dye has diffused from the pulp tissue into all the normal dentin. A section is now ground in such a plane as to include the experimental cavity and the pulp. On examination, it will be found that the

2. Footnote 1. Fish, E. W.: Physiology of Dentin and Its Reaction to Injury and Disease, Brit. Dent. J., 49:593 (June 1) 1928.

dye has diffused into all the uninjured dentin but that there is a patch of secondary dentin over the central ends of the injured tubules which has prevented the dye from entering them. (Fig. 1.) tissue between the primary and secondary dentin which appears to be the obstacle in the way of fluids diffusing from the pulp into the injured primary dentin. Now, this observation is the starting

Fig. 2.—Decalcified section of similar tooth to that shown in Figure 1. There is an almost complete absence of odontoblasts under the secondary dentin. The death and disappearance of these odontoblasts and therefore of the fibrils can be explained only by assuming that the tract of primary dentin is also dead. *S*, secondary dentin.

The tubules of the secondary dentin itself will be seen to contain the dye, but there is a homogeneous zone of calcified point of some important deductions, so important that it is necessary to control it in every possible way; for if this injured

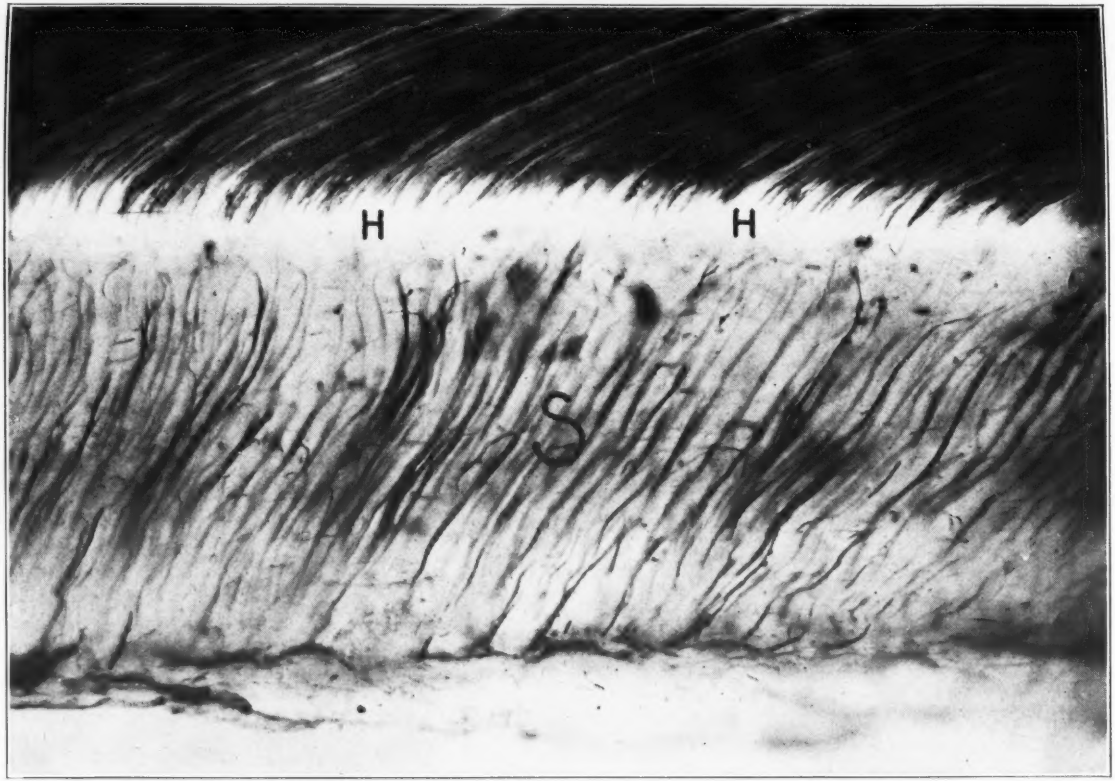

Fig. 3.—Ground section of monkey's tooth four weeks after cutting experimental cavity at the surface of the tooth to expose the dentin. The homogeneous zone separating the tubules of the primary and secondary dentin is seen. The tubules of the secondary dentin are not continuous with those of the primary but start as fine branches. *H*, homogeneous zone; *S*, secondary dentin.

Fig. 4.—Decalcified section of monkey's tooth four weeks after the cutting of an experimental cavity at the surface of tooth to expose the dentin. On the left side are seen the central ends of the injured tubules with degenerated odontoblasts; on the right, the uninjured dentin and normal odontoblasts. There is developing secondary dentin on the left. *S*, secondary dentin; *D*, degenerated odontoblasts; *N*, normal odontoblasts.

primary dentin is beyond the reach of fluids diffusing postmortem from the pulp, it is equally outside the pale of nutrition, which, in normal dentin, is afforded by fluids derived from the pulp; that is to say, it is dead.

In most cases of secondary dentin formation, there is also anatomic evidence that this injured primary dentin is cut off from the pulp in this way. The homogeneous layer of lime salts referred to may generally be seen in ground sec-

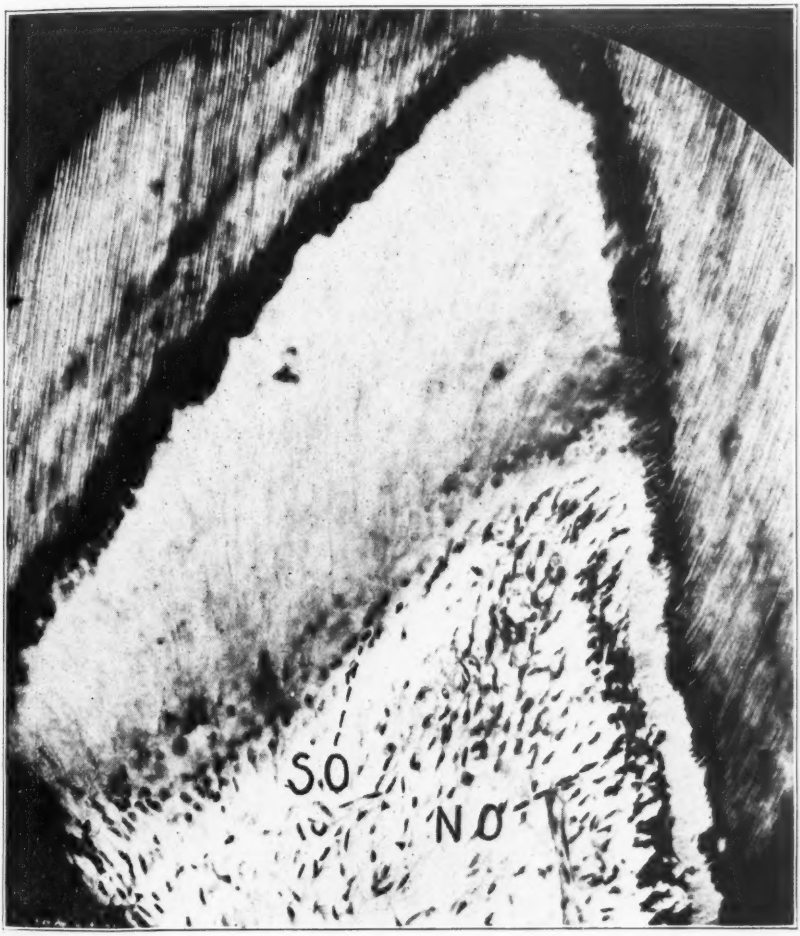

Fig. 5.—Same as Figure 4, but the monkey was killed eight weeks after the grinding of the surface of the tooth. The degenerated odontoblasts have disappeared and the secondary dentin is complete. *SO,* a few odontoblasts which survive; *NO,* normal odontoblast layer under uninjured dentin.

tion separating the primary dentin from the secondary. (Fig. 3.) The contents of the primary tubules are degenerated, and these tubules terminate abruptly in the homogeneous calcified zone. The new tubules of the secondary dentin are, moreover, reduced enormously in number, which precludes the possibility of

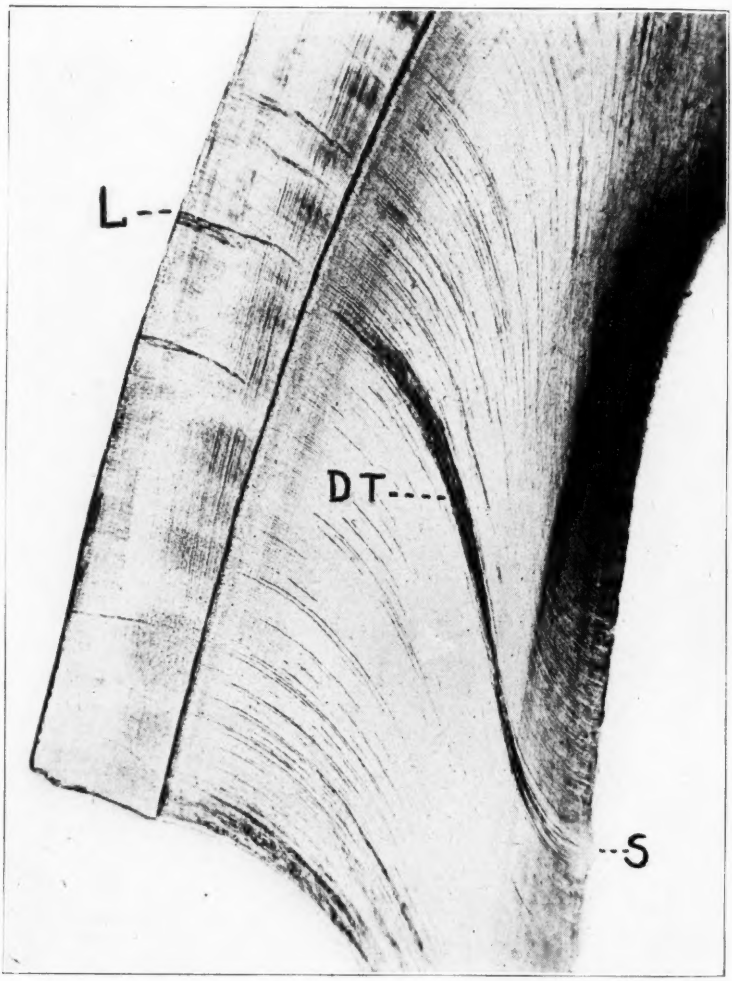

Fig. 6.—Permeable lamella in dog's enamel with tract of dead dentin under it walled off from the pulp by secondary dentin. *L*, lamella; *DT*, tract of dead primary dentin; *S*, secondary dentin.

about 90 per cent of the primary tubules being in direct continuity with the pulp through these relatively few secondary tubules. But perhaps the most striking anatomic evidence is that the tubules of the secondary dentin can generally be seen to take origin in fine branches under the homogeneous calcified zone (Fig. 3) jury has been slow in its onset, as, for instance, in attrition of this surface, that the tubules of the primary and secondary dentin appear anatomically continuous, although they are seen in decalcified sections to be separated by a heavily stained line of lime salts. Moreover, if dye is placed in the pulp of such teeth, there

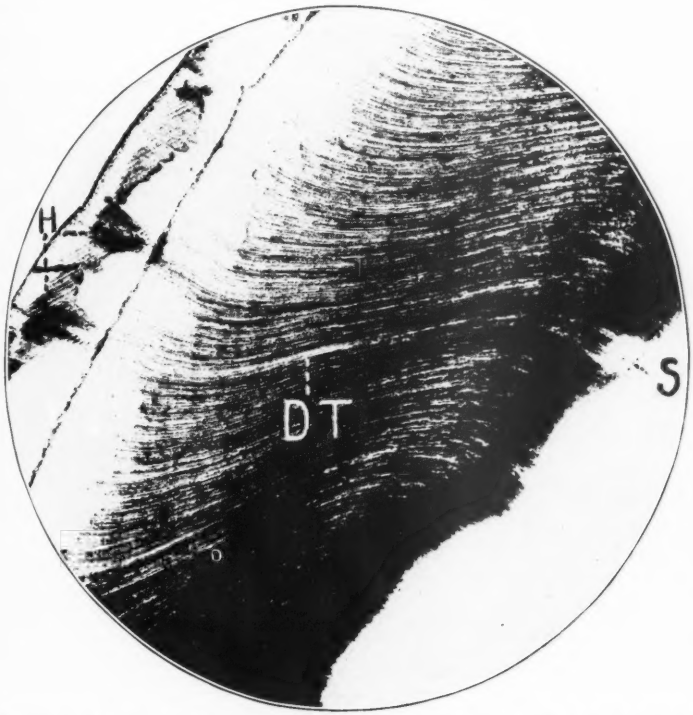

Fig. 7.—Permeable patch of hypoplasia of enamel (human) with tract of dead dentin under it walled off from the pulp by secondary dentin. *H*, hypoplasia; *DT*, dead tract; *S*, secondary dentin.

so that even the small number of tubules actually found in the secondary dentin are not in continuity with those of the primary dentin.

It will be observed sometimes, notably under injuries of the dentin of the occlusal surfaces of molars where the in- will be found to exist a barrier to the passage of the dye from the secondary to the primary dentin just as there was in the cases with a well-marked homogeneous zone. Here the barrier seems to consist of a plug of calcium salts in each individual tubule, and the odontoblast,

having survived the injury owing to its mild nature, proceeds to form a new fibril in line with the old channel. Such a case is shown in Figure 10, which, incidentally, also shows the importance of this barrier between primary and secondary dentin as a means of defense against caries.

The more typical case clinically and physiologically, as shown by the diffusion experiments. The latter dye diffusion experiments have been repeated intravitally,[3] in fact, they were always done intravitally at first,[1] and it was found that the result was exactly the same. The blue dye was carried into the normal dentin by the lymph circulation, but was prevented from entering the injured den-

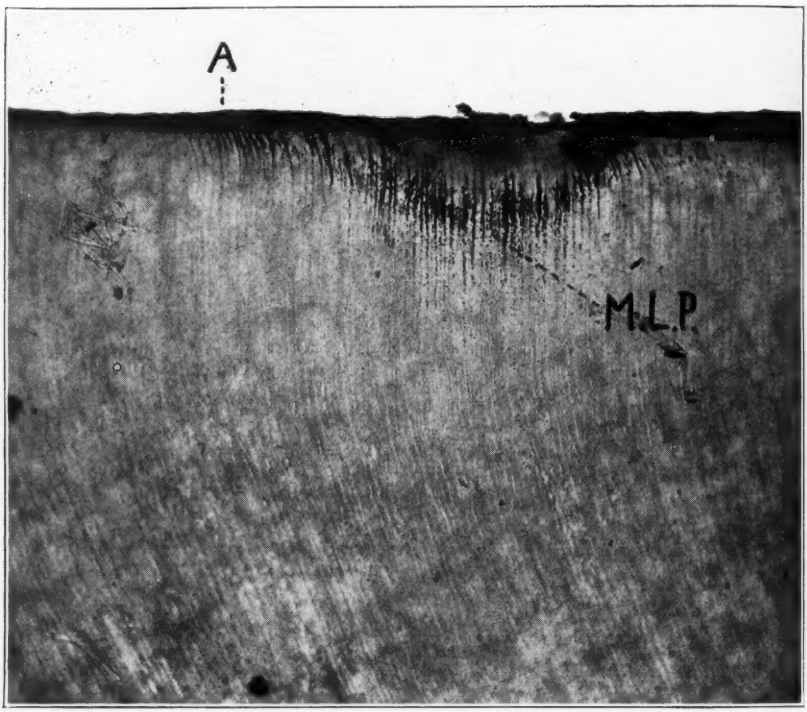

Fig. 8.—Lesion at neck of the tooth (human) where the gum has receded. The dentin is abraded and the marginal lymph plexus *(MLP)* is opened at one point *(A)* and has become infected. There is no caries. (Compare Fig. 9.)

the one met with in experimental injuries is the type having a homogeneous zone (Fig. 3) which produces a complete discontinuity between the primary and secondary tubules, both anatomically, as observed under the microscope, and tin by the patch of secondary dentin which was always found underneath it. The only difference between this and the postmortem experiment is that, in

3. Footnote 3, second reference.

one case, the dye is carried by diffusion; in the other, by the lymph circulation. The latter is therefore much quicker. The intravital method takes one day, but results are not so nearly uniform owing to the inevitable injury to the pulp. The postmortem method takes three or four weeks, but is completely uniform.

If diffusion is now attempted in the opposite direction, that is, centripetally, further evidence is procured. The experiment consists in cutting a cavity in the tooth of a live dog or monkey and introducing into it a swab moistened with a concentrated solution of methyl blue. The swab is covered with a cap, such as an ordinary "pulp cap," and cement is placed over the whole.

In twenty-four or forty-eight hours, the dye will be found to have diffused all along the injured tubules from the cavity and to have reached the pulp. It is therefore quite evident that if the cavity had been exposed to the fluids of the mouth, they also would have diffused into the tubules, and it is inconceivable that Tomes' fibril could remain alive in a mixture of saliva, food juices and lymph. Indeed, we shall see from the next experiment that not only Tomes' fibrils but

Fig. 9.—Pulp surface of the tract of dentin shown in Figure 8. The central ends of the infected tubules are covered with secondary dentin and the odontoblasts of these tubules have been destroyed by the peripheral infection and have disappeared. *T*, tubular secondary dentin; *L*, laminated secondary dentin; *NO*, normal odontoblast layer under uninjured tubules; *F*, fibrous tissue in contact with secondary dentin under injured tubules.

also many of the odontoblasts themselves die as a result of a peripheral injury to the dentin.

weeks later, making a series of decalcified sections of the tooth to show the changes which have taken place in the pulp under

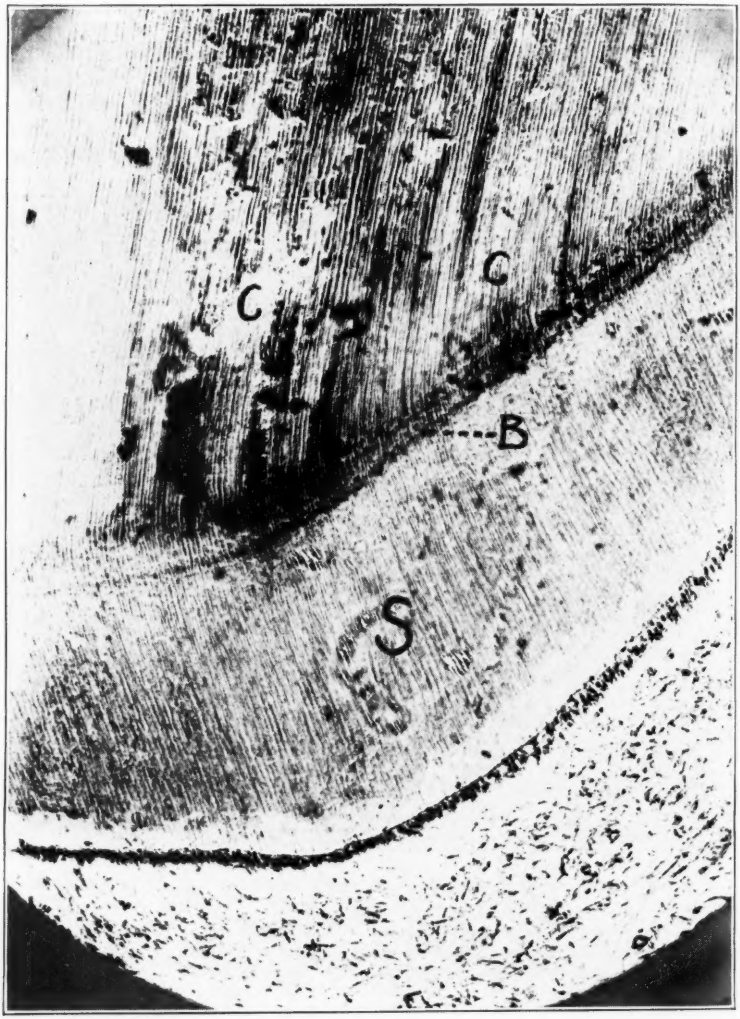

Fig. 10.—Decalcified section of temporary human molar. The caries is held up at the barrier between the primary and secondary dentin. *C*, caries; *B*, barrier; *S*, secondary dentin.

The experiment consists in cutting a cavity in a monkey's tooth and, some

the tract of dentin which has been injured. After four weeks, the sections

show at the central end of the tubules which form the floor of the cavity a patch of calcified tissue representing the beginning of a deposit of secondary dentin and, under it, a row of degenerating odontoblasts. These cells are shrunken, distorted and densely stained and have obviously been seriously affected by the lesion at the periphery of the dentin. (Fig. 4.)

is represented by a few isolated cells associated with the occasional tubules found in the secondary dentin. (Fig. 5.)

It is evident, if the odontoblasts themselves have degenerated and died, that the primary dentin in which they had their fibrils and through which the injury has reached them is also dead, and we have, moreover, a rational explanation of secondary dentin which we recog-

Fig. 11.—Cleavage *(C)* occurring at junction of primary and secondary dentin in human molar when the barrier between them is attacked by caries.

If now a similar series of decalcified sections are made of a tooth eight weeks after the cavity was cut, these degenerated odontoblasts will have entirely disappeared, and the row of odontoblasts, which is normally six or eight cells deep,

nize as an attempt by Nature to wall off a source of irritation (the injured and dead dentin) by lime salts from the pulp.

To summarize the evidence that the tract of primary dentin between the area

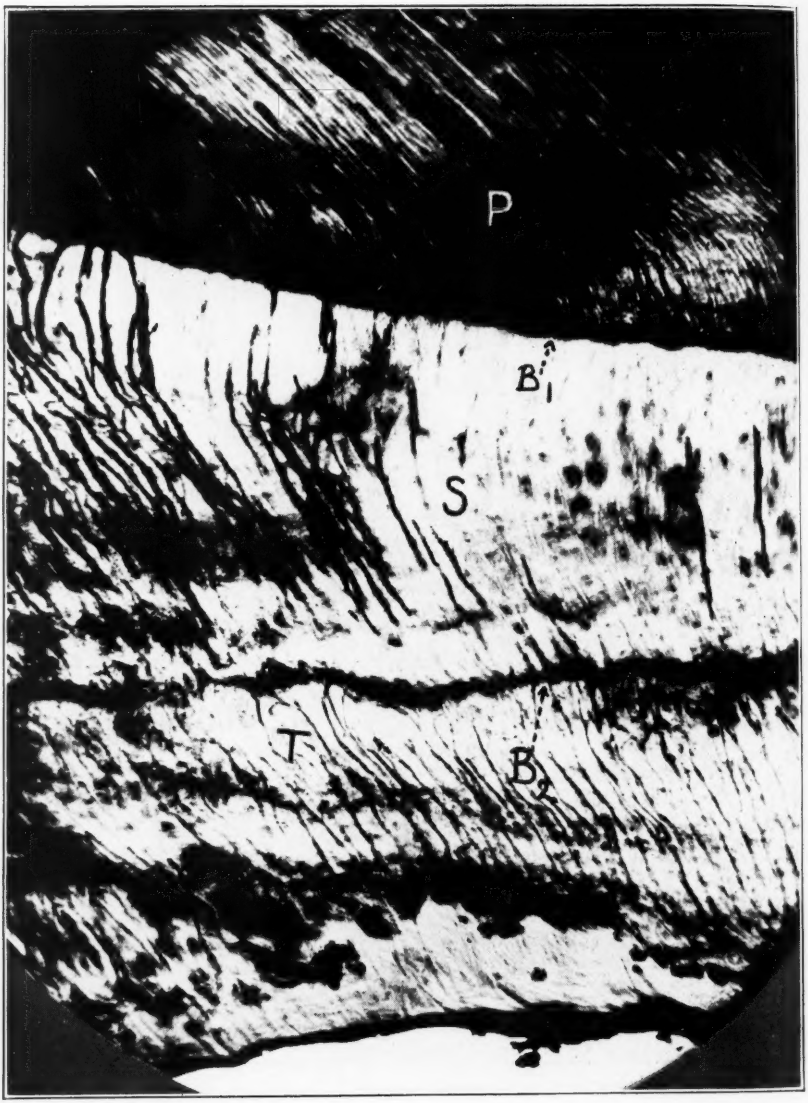

Fig. 12.—Secondary dentin attacked by caries at an advanced stage of the disease. A layer of tertiary dentin is seen to have formed with a further barrier between it and the secondary dentin. The tubules of both secondary and tertiary dentin start in fine branches under their respective barriers. *P*, carious primary dentin; B_1, first barrier; *S*, secondary dentin; B_2, second barrier; *T*, tertiary dentin.

of a peripheral injury and the pulp dies and is sealed off by secondary dentin, we may say:

1. Dyes introduced into the pulp do not reach the injured dentin although they diffuse readily into uninjured dentin.

2. The patch of secondary dentin is accurately confined to the injured tubules from which it is separated by a homogeneous layer of apparently impermeable calcified tissue.

3. The tubules of the secondary dentin are not, as a rule, anatomically continuous with those of the primary. They are never physiologically continuous. They may generally be seen to take origin in fine branches under the homogeneous zone.

4. When the peripheral end of a dentinal tubule is opened experimentally, dyes can be shown to diffuse along it. Mouth fluids would therefore do so and could not fail to kill the contents.

5. Most of the odontoblasts under primary dentin are killed by a peripheral lesion and disappear.

6. Where one of these dead tracts has become carious, we shall see that the tubules contain not only a necrotic fibril but often cocci also; and, further, that the caries is held up at the junction of the primary and the secondary dentin by an obvious barrier.

INJURY OF THE DENTIN FROM NATURAL CAUSES

There are at least four common ways in which the dentin is injured in the course of a normal human life. The first is by attrition; the second occurs at the neck of a tooth from recession of the gum followed by loss of the cuticle and the dead cementum. (Until these are lost and expose the dentin, it remains alive and sensitive.) The third and fourth are due to developmental faults in the enamel which, by constituting a leak in the enamel, expose the dentin to the mouth fluids. They are: severe hypoplasia and the presence of large enamel lamellae. Perfectly formed enamel is impervious to dyes and, therefore, to mouth fluids, but, in nearly every section of human enamel, we find several points at which the enamel is not normal and through which, if the fault is severe enough, the mouth fluids can penetrate. These hypoplastic faults and lamellae can be shown to admit dyestuff if the tooth is immersed in a solution of the dye for some weeks and then ground sections are made. (Figs. 6 and 7.)

In order to study the effect of these faults or injuries of the tooth by which, in each case, the mouth fluids are admitted to the tubules of the dentin, the same method is adopted as was used with experimental injuries, and precisely the same results are obtained.

If a dye is placed in the pulp and left for a few weeks to diffuse, a dead tract of primary dentin will be indicated beneath these flaws or injuries. This tract leads from the injured peripheral area to the pulp and is sealed off there from the pulp by a patch of secondary dentin (Figs. 1, 6 and 7). If the pulp tissue is examined in decalcified sections of teeth showing injuries from natural causes, it will be found that the odontoblasts immediately under the lesion are almost entirely absent, having died along with the fibril when mouth fluids entered the tubule. (Fig. 2.)

A further example of this is shown in Figures 8 and 9. Figure 8 shows the peripheral injury, consisting of recession of the gums and wearing away of the cementum. There is no indication of caries and the only injury to the dentin is that, at one point *(A)*, the mouth

fluids have gained access to the marginal lymph plexus *(M.L.P.)* referred to previously. Nevertheless, the tract of dentin has died, for, in Figure 9, we see the pulp margin exactly below this lesion, and there are no odontoblasts. Since these have been killed, we may well assume that the intervening dentin has also died. There is a further point shown in this specimen: the secondary dentin is tubular in the part first formed, but evidently the seal or barrier between the primary and the secondary dentin was inadequate, and the secondary dentin, becoming contaminated, also died, and likewise the few remaining odontoblasts which escaped the original injury. The dead secondary dentin was, in turn, sealed off with a laminated layer of lime salts, laminated because there were then no odontoblasts left to form tubules, and the connective tissue of the pulp is in direct contact with this laminated layer. We have, then, carried the argument a step farther, and we find, in human teeth, four common superficial injuries which have certain characteristics in common:

1. They are all leaks in the tooth surface permitting access of mouth fluids to the dentin.

2. The tract of dentin beneath them, being open to the mouth fluids, is sealed off from the pulp by secondary dentin.

3. This tract of exposed primary dentin is dead and the odontoblasts which were originally associated with it have died and disappeared.

THE ONSET OF CARIES

We have also one further characteristic which is common to these injuries, and that is the incidence of caries associated with them. Attrition is an exception to this statement, but an exposed neck of a tooth, a patch of hypoplasia of the enamel or a fissure at the bottom of which is a permeable lamella are the sites of election of caries. Lamellae are also especially abundant in the cervical third of the crown, and it is here that approximal caries starts.

In the case of cervical caries, it is obvious that the onset of the disease is merely a putrefaction of the dead tract of dentin already formed, and the incidence of caries in such a tract causes no further reaction in the tooth. There is no pain to mark the onset, as there was when the tract first became exposed and died, and there is no further reaction of the pulp. An effective seal of secondary dentin already walls off the pulp from the dead tract, and until the caries interferes with this seal, there will be no change except that, if the caries spreads laterally, the extent of the secondary dentin will keep pace with it.

In the case of caries of the crown, exactly the same phenomenon occurs. The caries starts in the depth of a permeable lamella (it cannot yet be stated definitely that caries cannot occur without a preexisting fault in the tooth surface), and the tract of dentin under this lamella is found to be already dead. The organisms from the lamella simply invade this dead dentin and destroy it. Similarly, under hypoplastic enamel, we find, first, dead dentin without any caries and then, later, the dead dentin becomes carious, but we never find caries without dead dentin which is cut off from the pulp by secondary dentin and which displays absence or reduction of odontoblasts exactly as we found it both experimentally and under areas showing natural injuries of the dentin before caries had occurred. It would therefore appear likely that caries is always preceded by development of a tract of dead dentin.

EXTENSION OF THE CARIOUS PROCESS

It may be of interest in conclusion to trace the course of the carious process from the surface to the pulp. Once the organisms have gained access to the dentin, they grow down the tubules without any interference as far as the junction of the primary and secondary dentin. In the few cases, where a translucent zone is seen, it may hold the organisms up to some extent in an irregular manner, but the translucent zone itself is very uncommon. When it does occur, it precedes the caries and is merely the early reaction of the dentin to a source of irritation which is not sufficient to coagulate the lymph in the tubules and which does not therefore destroy the dentin. The irritation must fall short of actually opening the dentinal tubules to the mouth fluids, therefore, and Tomes' fibrils appear in these cases to cause a deposition of calcium salts from the lymph on the walls of the tubules.

When, later, the injury increases and causes death of the dentin, this translucent zone remains, but no case has yet been observed in which it was complete enough to protect the deeper layers of the dentin from death once the superficial injury opened the tubules to the mouth fluids. Similarly, in the few cases in which this zone appears, it does not prove to be any serious barrier to the caries.

We do find a very definite checking of the cocci infecting the tubules at the junction of the primary and secondary dentin, and this may be regarded as the first line of defence. The actual obstruction to the infecting agent appears to be the homogeneous layer of lime salts which is first laid down and seals off the primary dentin when it dies. Figure 10 shows how the organisms are held up at this barrier and provides striking corroboration of the experimental evidence of the existence of an impervious layer of lime salts in this situation.

In some cases, this barrier is so effective that when it is finally invaded by the fermentative type of organisms, a fissure is formed by the gases produced, and the primary and secondary dentin are split apart, as though by a miniature explosion. (Fig. 11.)

In other cases, the barrier appears to be less efficient and is fairly easily crossed. The secondary dentin then becomes infected. When this occurs, the source of irritation is much nearer the pulp than when the primary dentin was first invaded by mouth fluids, so that not only do the secondary dentin and its odontoblasts (if any) die, but there is also some risk of the pulp's becoming infected and sharing their fate. As a rule, the trouble is limited to the odontoblasts, and a new layer of secondary dentin, or, more accurately, "tertiary" dentin, is formed. The appearance of this layer differs according to whether or not there are any surviving odontoblasts after this second onslaught. In any case, there will first be a deposit of calcium salts shutting off the dead secondary dentin, and then, if any odontoblasts survive, they will lay down fresh tubules, which are recognized by their branched terminations. (Fig. 12.)

More commonly, there are no odontoblasts left, and the tertiary dentin is a mere laminated patch deposited by cells of the pulp, presumably modified for the purpose. (Fig. 9.) This new barrier between the secondary and the tertiary dentin is a second line of defence, and specimens often show three or four repetitions of this process before the pulp becomes exposed.

The laminated type of the secondary dentin, which is produced after the odon-

toblasts have all died, is a less efficient protection to the pulp, since there is no possibility of any warning to the pulp passing its impervious laminations, so that the pulp cannot and does not react until it is too late and exposure has occurred. On the other hand, while there are still any tubules in the secondary dentin, their death provides just the necessary stimulus to the pulp to cause it to form a fresh layer of lime salts but does not produce enough irritation to kill the pulp.

ORAL PROPHYLAXIS DURING ORTHODONTIC TREATMENT*

By F. BLAINE RHOBOTHAM, D.D.S., Chicago, Ill.

As the terms "prophylaxis" and "hygiene" are so frequently misused and their meanings are so closely associated, for clarity it may be helpful to define each in a simple and effective manner.

"Prophylaxis" refers to any effort employed to prevent disease, while "hygiene" refers to any effort employed to maintain health. In view of the fact that the prevention of disease necessitates the maintenance of health, let us use the term "prophylaxis" in its broadest possible scope. And as long as oral health and the prevention of disease in the mouth depends on the general hygiene of the entire body, let us view our problem comprehensively.

Oral prophylaxis reaches its maximum in service to humanity during childhood, for most of the complications of adult dentistry can be avoided if proper prophylactic care is instituted during the period of childhood.

It is not within the province of this paper to discuss the duty of the dentist to the child in the procedure of ordinary dental care but in the more complicated problem of giving intelligent service during orthodontic treatment.

To be logical and orderly in this discussion, let us outline a definite procedure. The orthodontist's responsibilities in the prophylactic care of each patient are several.

His first responsibility is the general health of the patient. As the success of orthodontic treatment is limited by the physical and mental well-being of the patient, definite assurance of the patient's fitness should be confirmed by the physician. Without this stimulation, bone development and bone metabolism generally may be interfered with and the process may even prove to be detrimental.

Our present knowledge includes the relation of sunshine, cod-liver oil, ultraviolet rays and diet to bone growth and development, and these facts must be dealt with intelligently if the best orthodontic results are to be obtained. Anything contradictory to these principles is unscientific and is opposed to real prophylaxis.

After a check-up of the patient's general health has been made and the diet and contemplated therapy have been considered, the second step is a comprehensive

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examination of the mouth. Are signs of mild scurvy, calling for corrective diet, evident in the soft tissues? Are there signs of mild gingivitis as the result of improper care or lack of care of the mouth? Do roentgenograms show infected root ends in either the permanent or the deciduous teeth? Are there cavities that need filling and are there improperly placed fillings that need attention? Are the teeth so susceptible to caries that orthodontia should be delayed until the condition has been improved? Do the first permanent molars need restoration that will bring them up to anatomic size and form?

Each one of these questions should be analyzed by the orthodontist, and no orthodontic work should be attempted until he is satisfied with the result in each instance. Not until the mouth has been placed in order and not until the orthodontist has been assured, by a trial period of observation, that the patient and his guardians will maintain a degree of efficient hygienic care should work be started.

The orthodontist's third responsibility is in properly placing the appliance so that there is a minimum of irritation to the soft tissues, so that there is not undue pressure brought to bear on any tooth and, above all, so that there are no leaks under the bands in fixed appliances. These precautions must go farther than the original planning and observation of the "set-up case." They require regular check-ups. Undue irritation to the soft tissues may result in gingivitis, with all its dire sequelae. Bleeding gums furnish an ideal habitat for the growth and production of various bacteria, particularly those of diphtheria and tuberculosis. These pernicious germs are a constant threat to their host.

Too much emphasis cannot be given to the necessity for constant examination of cemented bands. Most of the etching of the enamel found after the removal of appliances is traceable to this neglect. This is true particularly of retaining appliances, which too frequently are not checked up.

The fourth responsibility of the orthodontist is perhaps the most pertinent of all. It concerns the regular cleaning of the teeth and the appliances.

During orthodontic treatment, the teeth are subject to the collection and retention of more food débris than under ordinary conditions. It is, therefore, important that more care be taken by both the patient and the orthodontist to maintain a clean, wholesome mouth. Many perfect orthodontic results have been dimmed by the ravages of decay. Corrective work is usually indicated during the periods when children are most susceptible to caries.

The general practitioner finds it almost impossible thoroughly to clean the teeth when complete orthodontic appliances of the fixed type are in place. It is difficult to arrange concurrent appointments with the orthodontist for removal of the appliance, and with the dentist for prophylactic attention, and then go back to the orthodontist for replacement of the appliance. It would seem, therefore, that the logical place for prophylaxis is in the office of the orthodontist. In states in which the license laws permit, the orthodontist's office is an ideal place for the dental hygienist, for she can be of great service to the busy orthodontist and a real economic factor in his practice.

The accumulation of carbohydrate food débris on and about the teeth is a factor in the production of the decalcifying agents, the forerunners of caries.

The direct or indirect splitting up of these carbohydrates by fission fungi into acids, principally lactic acid, furnishes the attacking agent that decalcifies enamel. The hygienic care of the mouth tends to keep the mucous membrane and the teeth in a healthy state by overcoming these destructive processes. Nature has instituted protective measures of her own to accomplish the desired end. The normal mouth is fairly well protected against bacterial action by the rich blood supply to the oral tissues, by the high resistance of its epithelial lining and by a free flow of saliva.

The vigorous use of the organs of mastication in chewing properly selected foods will bring about an active circulation and stimulation to the parts involved, and, as a consequence, a rich flow of saliva, which is required for the washing away of food débris.

As a result of our present methods of selecting and preparing foods, and consequent insufficient mastication, the quantity and quality of saliva are often inadequate to bring about a proper physiologic cleansing of the mouth. To overcome this deficiency, suitable mechanical and chemical means may be employed.

The fundamental principle of artificial oral hygiene is the mechanical cleaning of the mouth and teeth by means of brushes, powder, paste, dental floss, mouth washes and the like. Food remnants and slimy adhesions between and on the teeth are principally removed by mechanical cleaning as far as office treatment is concerned.

When fixed appliances are used, the arches, ligature wires and all removable parts should be removed before the prophylaxis of the teeth is begun. Flour of pumice and brushes should be employed not only to remove stains and débris but also to polish all exposed surfaces. The porte polisher is often very effective about the anchor bands. Dental floss carrying wet pumice should be used to polish the proximal surfaces.

Brass wire ligature is often used in ligating teeth. It leaves in its wake a greenish stain, which is removed with difficulty. Linen strips will remove this stain if it has not been permitted to remain on the teeth too long. The use of brass wire should be discouraged as it is possible to obtain a gold plated wire which is comparatively inexpensive and which lacks the ugly staining qualities of the brass wire.

The teeth should be cleaned in the orthodontist's office whenever indicated. To some degree, such care is needed after nearly every delayed appointment. At each visit, the condition of the soft tissues should be under scrutiny and necessary treatment given.

Arches must also be cleaned before being replaced. There are three ways to clean them: (1) by boiling in hydrochloric acid; (2) by use of pumice and a felt cone on the laboratory lathe, and (3) by using pumice and a brush in the engine handpiece.

The fifth—possibly as important as the fourth—responsibility in instruction of the patient concerns home care of the mouth. It has been assumed that the patient has brought the mouth up to a definite standard of hygienic care before the treatment for orthodontia has started. There are certain new instructions that deal particularly with the sane prophylaxis of the mouth, when appliances are being worn.

In the case of removable appliances, the instructions (except in the varied interrupted type of treatment) are as follows: Keep the appliances in the mouth at all times, except when brush-

ing the teeth; brush the teeth in the regular way; brush the appliances very carefully to avoid distortion, and brush the teeth and appliances at least after each meal.

Fixed appliances of the lingual type are less complicated and so are more easily kept clean, but when the type with bands, arches, hoods and spurs is used, more care must be exerted by the patient in brushing. A small stiff-bristled brush, preferably with one row of bristles, has proved most efficient to clean to the gingival aspect of the arches. To the occlusal aspect of the arches, it is necessary to use not only the up and down, but also the back and forth movement.

A tooth paste or powder with an abrasive base proves the most valuable aid in polishing the metal bands and arches. It may be well to mention here also that the precious metals are more easily cleaned and are less likely to discolor the enamel.

A helpful habit to establish in the patient who is undergoing orthodontic treatment is the immediate forceful rinsing of the mouth after each meal. Powerful exercise of the muscles of the pharynx, the cheeks and lips will force the fluid back and forth through the teeth, preventing the adhesion and retention of food particles.

Perhaps the additional use of a mouth wash has its advantages, especially if a simple, effective one is selected. Lime water makes the ideal mouth wash, as it is not only an enemy of lactic acid, which is active in the destruction of the mineral salts of the teeth, but is also a solvent of mucin, which also is a factor in initial caries. If the taste of lime water is objectionable, it can be flavored to suit the patient's preference.

Diet is another factor in home care. A well balanced diet is recommended, with the avoidance of sticky, chewy foods, not only because they adhere to the bands and teeth but also because they constitute a danger through loosening the bands. Coarse, hard foods, which necessitate vigorous mastication and which stimulate the flow of saliva, are indicated from the prophylactic as well as the orthodontic standpoint. The mild fruit acids are natural cleansing agents. Apples probably outrank all other fruits in their ability to facilitate mouth hygiene.

The orthodontist's responsibility in regard to oral prophylaxis may be summed up as follows: A check-up should be made of the patient's general health and fitness for treatment; the patient's mouth should be restored to as healthy a state as is possible without orthodontia, and a trial treatment should be given in order to ascertain the patient's ability and willingness to cooperate in a mouth hygiene program during the treatment. The selection and placing of the appliances should be done with the safety of the hard and soft tissues of the mouth uppermost in mind. The teeth and appliances should be cleaned and kept in order in the orthodontist's own office, the responsibility of the prophylaxis of the teeth and soft tissues resting squarely on the orthodontist's shoulders. In cases in which the law permits, the dental hygienist is the economic and logical person to carry the burden of the actual cleaning of the teeth and appliances. The patient should be instructed as to the home care of the mouth and should be in complete cooperation with the dental office treatment.

A plea is added, in closing, that we consider oral prophylaxis in its broadest meaning and that we apply every principle of our knowledge to the honor and glory of the profession and to the everlasting benefit of our clientele.

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ANESTHESIA FOR DENTAL OPERATION*

By JOHN S. LUNDY, M.D., Rochester, Minn.

THE question of anesthesia in dental operations has probably always occupied the attention of the dental profession. This was especially true in 1844 when Horace Wells administered nitrous oxid for the extraction of a tooth. Many advances over the original method have been made in the administration of nitrous oxid and these have been extended to apply to other methods of anesthesia. I will mention but two of these: (1) the suggestion of E. Willis Andrews, of Chicago, in 1868, that oxygen be used with nitrous oxid, and (2) the suggestion of Yandell Henderson, in 1924, that carbon dioxid also be added. Henderson, who had for years been pointing out the value of carbon dioxid in acapnia, in shock and after anesthesia, reported more than 100 cases in which, at Henderson's suggestion, Sword had administered carbon dioxid during anesthesia with gas in 1923. After 1924, the use of carbon dioxid in anesthesia for general surgery spread rapidly throughout the English-speaking world, and, in the last year, the popularity of carbon dioxid for dental operations has given promise of being equally widespread.

NITROUS OXID

Nitrous oxid and procain share the burden of relieving pain in most dental operations. Some dentists advocate the use of nitrous oxid as a routine measure in the anesthetization of patients for dental operations, and I believe that, in the majority of instances, nitrous oxid may be used with safety for patients who are to undergo such operations. I wish to call attention to the fact that all patients do not do well under nitrous oxid anesthesia. About eight years ago, I was consulted concerning two patients who died two or three hours after the extraction of teeth under this type of anesthesia. In each patient, at necropsy, there was found a fatal hemorrhage, evidently due to a sudden extreme elevation of blood pressure. I have shown that the blood pressure under nitrous oxid anesthesia may rise from 160 to 300 (systolic) in twenty minutes or less.[1] Such an elevation of blood pressure may be partly due to the nitrous oxid and partly due to a state of asphyxia which may sometimes exist during anesthetization. For those who wish to use nitrous oxid as a routine, and who feel that carbon dioxid will eliminate the danger of asphyxia, I would point out that carbon dioxid itself has a tendency to raise the blood pressure slightly. It would probably be safer to use a local anesthetic, such as procain, for patients with cardiovascular disease, with or without hypertension,

*From the Section on Anesthesia, the Mayo Clinic.

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1. Lundy, J. S.: Keeping Anesthetic Records, and What They Show, Am. J. Surg., 38: 16-26, 1924. (Anesthesia supp.)

arteriosclerosis or both; for example, in a patient with syphilitic aortitis.[2]

It is important, for purposes of safety, if patients have not had medical examinations, to look with suspicion on those aged more than 40 years, particularly men. Barnes,[3] who has called attention to the risks associated with local and general anesthetics in dental operations in the presence of acute respiratory infections, purulent processes, diabetes, hyperthyroidism and renal insufficiency, states:

> The operative and anesthetic risk in heart disease is determined by the patient's response to effort. If effort is not followed by unwarranted dyspnea, pain or tachycardia, and later, edema, the cardiac defect is compensated and an anesthetic may be given safely. The risk in cases of valvular heart disease is gauged by the same principle. Angina pectoris is the most serious cardiac syndrome confronting the dental surgeon and causes most of the sudden deaths from cardiac disease. When this syndrome is present, as well as in cases of hypertension, the functional capacity of the heart should be investigated before an anesthetic is given. Besides the history of the patient's response to effort and the findings on physical examination, the electrocardiogram is helpful.

LOCAL ANESTHESIA

There are many who advocate the use of local anesthesia for dental operations. I do not advocate such use of any one agent as a routine measure. If a routine must be followed, local anesthesia satisfies all requirements more nearly than does nitrous oxid anesthesia.

BARBITURATES

The barbiturates may be used to some advantage for certain nervous or noncooperative patients or for those who have experienced untoward results following the use of procain. Small doses have been given orally with satisfactory results in quieting nervous patients and even have been used in the mentally deranged. I have used barbiturates several hundred times, intravenously, to produce anesthesia for surgical operations and have found that this form of anesthesia has some advantages and some disadvantages as compared with gas anesthesia. As an anesthetic for dental operations, it is not practical; but as a hypnotic, it may be used to advantage in many instances in certain types of patients, particularly to allay fear.

EPINEPHRIN AND EPHEDRIN

It is not always wise to use epinephrin with injections of local anesthetics, particularly in the case of nervous patients, such as those who have exophthalmic goiter. One should always be careful of the amount of epinephrin which is mixed with solution of procain and injected into the tissues. Many persons complain bitterly of the discomfort and the disagreeable sensations which they have experienced after an injection of procain and epinephrin. Patients show signs of marked untoward reaction if the drugs have been injected directly into a vessel. Through the cooperation of L. T. Austin and W. G. Webb of the Mayo Clinic, an attempt is being made to find a substitute for epinephrin. We have tried ephedrin, but, thus far, we have failed to produce as dry an operative field with ephedrin as with epinephrin. On the other hand, we feel that ephedrin does not produce the disagreeable systemic effects that are sometimes seen when

2. Barnes, A. R.: Risks of Local and General Anesthetics and the Treatment of Untoward Effect. (Unpublished data.) Risk of Dental Surgery Especially in Cases of Cardiovascular Disease, J.A.D.A., 13:1433-1438 (Oct.) 1926.

3. Barnes, A. R.: Recognition and Care of Patient Presenting an Increased Risk in Dental Surgery; to be published.

epinephrin has been used. This problem should be given the attention of the dental profession, and a search should be made for some agent which will give a dry operative field without producing untoward systemic effect.

ETHYLENE AND ACETYLENE

I will not discuss the use of ethylene and acetylene for dental operations. I believe that these agents, while they may be used with advantage by a few, are less practical for widespread use and certainly less safe from the standpoint of inflammability and explosibility than procain or than nitrous oxid with or without carbon dioxid.

THE POOR RISK

For the patient in average health, nitrous oxid and procain seem to be uniformly satisfactory. The dentist must decide on his preference or the patient's preference when there is a choice. Under these circumstances, it seems to me that the dentist would be wise to consider first the agent or agents with which he is most familiar and in the use of which he is most skilful. Unless a good reason is advanced for using another agent or method, he would do well to use the agent of his own choice.

I have been asked to consider, from the dental standpoint, the patient who constitutes an unrecognized poor risk for anesthesia rather than the patient in average health. I shall consider this subject briefly from three points of view.

The questions that arise are: How can the presence of poor risks be recognized? What preanesthetic preparation should be used? When the presence of a poor risk has been recognized, and the patient has been prepared, how shall he be anesthetized?

In order to recognize the occasional patient who constitutes a poor risk in the ordinary group of patients who are in average health, it is essential that certain questions be asked concerning the health of each patient in the past. There are many questions that might be asked, but there are a few that must be asked. The patients should be asked whether there is pain in the region of the sternum (breast bone) with or without exertion. If such pain is present, and the patient is 40 years of age or older, and a man, one must suspect that angina pectoris is present. This constitutes one of the gravest and most common risks encountered in anesthetizing a patient for a dental operation. The patient should be asked whether he suffers from dyspnea (shortness of breath) or shows any sign of fatigue on exertion such as walking, not running, upstairs.

If the patient has had dyspnea and weakness on exertion, one must suspect a weak or diseased heart. It is important to take the blood pressure of patients aged more than 40 years and to know whether or not it is higher than it should be. It is desirable to ascertain whether, if the patient is a male, excessive bleeding ever has been noticed after slight injury, or whether his male ancestors have been bleeders.

With the idea of detecting signs of toxic goiter, it is important to count the pulse rate to see whether it is very fast and also to inquire concerning the patient's tolerance for heat and whether or not he is particularly nervous. It should be noted whether or not exophthalmos is present. One might go on indefinitely listing questions which might aid in revealing various pathologic conditions, such as diabetes and pulmonary disease, the symptoms of which the patient may or may not recall. For purposes of brevity, in this paper I have cited only a few

of the several questions that might be asked.

If pathologic conditions are suspected from the answers to the foregoing questions, it would be wise for the dentist to insist that the patient have a general examination by a physician, for the protection of both the patient and the dentist. It seems impractical for the dentist to make an extensive examination. The dentist should see to it that the rate of the pulse is counted and that the blood pressure is taken in his own office. This should be done almost as a routine, not only for the protection of the dentist and the patient, but also to make it possible for the person who is making the observations to become proficient.

The patient with angina pectoris should be protected against excitement and fear. Various hypnotics may be used to advantage in accomplishing this. Some of the best to be found are among the sodium salts of the various barbituric acids; such as, sodium isoamylethyl barbituric acid (amytal), phenobarbital (luminal), and barbital (veronal). A relatively small dose (from 3 to 6 grains by mouth an hour before operation) is usually sufficient to produce the desired result. For some patients, a larger dose is necessary. In cases of angina pectoris, it would probably be best to employ a local anesthetic such as procain, without using epinephrin. For the patient with a weak or diseased heart, it would be as advantageous to use procain without epinephrin, as it is in a case of high blood pressure, but it is not essential that a hypnotic be used preoperatively.

If hemophilia has been discovered, it is important to give the patient a general examination, to know the clotting time of the blood and to institute treatment with the idea of reducing the time in which the blood will clot to within fairly normal limits. In these patients, it may be also wise to inject epinephrin and procain near the site of operation, with the idea of further reducing the bleeding.

COMMENT

It would be advisable for dentists to familiarize themselves with the questions which tend to bring to light unsuspected pathologic conditions. I believe that it is desirable for the American Dental Association to make a short history card, listing questions which accomplish this purpose. This could be done after a painstaking survey of the difficulties which may arise from anesthesia of patients who constitute poor risks and in whom the pathologic conditions may go unrecognized previous to anesthesia. These cards could be used in the dentist's office by his nonprofessional assistants, who then might question a patient at the time the appointment is made. To be thus forewarned is to be forearmed.

CONCLUSIONS

1. The use of nitrous oxid for some patients seems to be contraindicated.

2. Local anesthesia has a very wide field of application, particularly in the presence of poor risk.

3. Barbiturates may be used to advantage to control fear and nervousness in noncooperative patients, but are not indicated for the purpose of producing anesthesia for dental operations.

4. Epinephrin should be omitted in many cases.

5. Ephedrin does not seem to be suitable for use with local anesthetics in dental operations.

6. Because of their explosibility and inflammability, ethylene and acetylene are not so practical for use in dental cases as nitrous oxid.

7. Each patient should have at least

a partial examination before being anesthetized and should be questioned concerning a history of previous illness.

8. Patients in whom certain pathologic conditions are suspected should be referred to a physician for examination.

9. Certain precautions should be exercised in some conditions to prepare the patient for anesthesia.

10. An anesthetic which seems least likely to cause an untoward reaction during or after operation should be used.

DISCUSSION

J. A. Heidbrink, Minneapolis, Minn.: I share the opinion expressed in Dr. Lundy's statement that he does not advocate the routine use of any one anesthetic agent. I have frequently expressed the view that, in selecting the anesthetic for dental surgical operations, we should consider the patient's fitness to take the anesthetic, the condition of the tissues involved in the field of operation, the character of the operation to be performed and the patient's preference. In making the further statement that "if a routine must be followed, local anesthesia more nearly satisfies all requirements than does nitrous oxid anesthesia," Dr. Lundy may have considered only the possible dangers incident to the diseases which he calls attention to as being unfavorable to general anesthesia. I wish to call attention to certain other considerations which should influence the choice of an anesthetic to be used routinely. Often the tissues surrounding the field of operation are infected, inflamed and swollen. Edema and pus may be present. Tissues that are infiltrated do not receive injections without considerable pressure. In any such case, there is grave danger of spreading infection by injecting. In many cases, the inflammation cannot be otherwise reduced, and operation is necessary. There are times when we must choose the lesser of two evils. We might, for instance, have a patient with a heart condition unfavorable to general anesthesia and with infected and inflamed tissues unfavorable to injection. Certainly, in such a case, I would consider it much less hazardous to carefully administer nitrous oxid-oxygen. It is my practice to consult the physician of patients with known physical handicaps of a serious nature, and if we are not in accord as to the best anesthetic to use, a little discussion brings us into agreement. I would hesitate to administer an anesthetic against the advice of the physician. I believe that we should be prepared to use local, block or general anesthesia as the case requires, and that no one anesthetic used exclusively will suffice if the patient's best interests are to be served. Some patients abhor the needle puncture for injection. Others dislike losing consciousness as with a general anesthetic. When conditions will permit the use of the anesthetic for which the patient may have a decided preference, he should be allowed to choose his anesthetic. If the operation is such that the patient's cooperation and a bloodless field are required for its most careful performance, local or block anesthesia should be suggested and even insisted on. In the presence of inflammation, swelling or pus in the tissue to be injected, local anesthesia should be refused. From my experience, and from the experience of others, I have gained great confidence in the relative safety of nitrous oxid-oxygen if it is carefully administered. Years ago, I had occasion to inquire of a number of men having long experience with nitrous oxid as to its safety. Without an exception, they reported many years' use of nitrous oxid, ranging from sixteen to forty years, with no fatalities. Some had used only nitrous oxid, but no oxygen. The outstanding report was that of Laird W. Nevius, who had for forty years administered nitrous oxid with no oxygen, without a fatality. He used no other anesthetic, and no physical examinations were made. He recorded more than 100,000 anesthesias some years before his death. Years ago, Dr. Teter reported 75,000 cases without a fatality. These clinical records might be looked on as indicative that really dangerous perambulating risks are rare. If there are only a few, they are worth any effort that we may put forth to detect and protect them. With heart or other pathologic conditions sufficiently developed to seriously contraindicate general anesthesia, people are quite likely to have symptoms which apprize them of the fact. They are likely to be under treatment and have received warnings which they invariably communicate to the dentist. It may be that sufficient of the bad risks have been thus identified and given special consideration to make possible such remarkable

clinical records. Dr. Lundy's suggestion that we take further steps to discover and reduce the bad risks is in accord with progress. The only question, I believe, is, How far should we go in making preliminary examinations? If we accept his suggestion, we have that problem before us. Dr. Lundy has outlined a procedure by which we can make a beginning. As to whether nitrous oxid raises the blood pressure and how much, authorities differ. Evans says[5]: "It is generally agreed by those in a position to judge of the virtues of the various anesthetic agents that nitrous oxid is not only pleasantest to inhale, with fewer disagreeable after effects, but is the least toxic, and, in the hands of the trained anesthetist, the safest. Its chief and perhaps only danger, if pure gases are used, is that of asphyxia." According to Klikowitsch, nitrous oxid with 20 per cent of oxygen is not only harmless but also actually beneficial for certain conditions. Gwathmey, in his excellent book on anesthesia, refers to the work of this investigator as follows: "Under the influence of nitrous oxid with 20 per cent oxygen, Klikowitsch found in the majority of healthy individuals accelerated cardiac contraction, diminished pulse waves, rarer and deeper inspirations. In cases of weakened heart action, an unfavorable influence upon the heart not only failed to occur but a favorable effect was actually demonstrable. The cardiac contractions, while somewhat diminished in number, were increased in efficency. For these reasons, as well as on account of the beneficial influence on attacks of angina pectoris, Klikowitsch employed nitrous oxid for therapeutic purposes." McKesson says: "High blood pressure does not contraindicate the use of gas-oxygen, since blood pressure is generally elevated only by struggling, which is less frequent under this than other anesthetics. The old impression that gas-oxygen elevates blood pressure has been exploded in recent years by thousands of tests made during operations upon patients of various ages and pathological states." Gwathmey says: "Blood pressure is always increased with nitrous oxid given alone. With a judicious use of air or oxygen nitrous oxid, anesthesia may be continued for a sufficient time to permit of any ordinary surgical intervention with little variation in blood pressure. Concerning the blood pressure, Goldstein's findings showed a marked increase to be exceptional, in contradistinction to the usual belief that blood pressure rapidly undergoes an enormous increase in the first stages of the asphyxiation. His first experiments concerned asphyxiation with nitrogen and hydrogen, but a considerable rise of the blood pressure was likewise absent with nitrous oxid, although some increase was present. The blood pressure underwent no essential changes when dogs and rabbits were given, in addition to the nitrous oxid, a quantity of air sufficient for the avoidance of dyspnea." Dr. Lundy cites two cases of death from hemorrhages of the chest two or three hours after nitrous oxid anesthesia for tooth extraction. It would appear that death would result more quickly after rupture of the aorta. If so, and if a rise in blood pressure during the anesthesia caused the hemorrhage, it would seem that death would have occurred at that time. Because two or three hours elapsed after the anesthetic was eliminated, one might suspect coincidental death or that there were contributing causes other than administration of the anesthetic. Dr. Lundy and some other authorities have found that any asphyxial tendency during anesthesia may increase the blood pressure. This emphasizes the need for careful administration and the use of plenty of oxygen as a factor of safety.

Roy S. Hopkinson, Milwaukee, Wis.: It seems strange that men whose experience is based on hundreds of thousands of clinical cases and who have been in the practice of oral surgery and exodontia for years, have had none of these alarming things happen that Dr. Lundy has mentioned. Not long ago, I was at a staff hospital meeting when, after a rather heated discussion, an eminent internist was asked the question, "Can you always detect angina pectoris when you make an examination?" Now that is a rather pertinent question, and after a minute of consideration, he said, "No." The problem resolves itself thus: If internists who are unquestionably qualified to make these examinations cannot detect a cardiac condition that Dr. Lundy mentioned as the most serious, how are we as dentists to recognize that condition? He has also stated that it is impractical for dentists to make physical examinations, and while we have always been told this, we have admitted for years that it is almost impossible to accomplish the ideal in the average office

5. Evans: Am. J. Surg., April, 1916.

where exodontia and oral surgery is being done. The most important suggestion that Dr. Lundy has made is that the American Dental Association distribute to the members of the profession clinical examination cards that will suggest certain pertinent points that should be covered before we take the risk of giving an anesthetic. Often we hear men say that every patient should have a complete physical examination, including blood tests, and, in fact, everything should be done that is suggested by the most ideal technic, but few men can afford to practice that kind of surgery in their offices and a still smaller number do. It takes an expert to make a physical examination that is worth anything, and I do not believe that we can expect every one of our patients who come to us for the removal of teeth to submit to such examinations. On the other hand, we do know that many of our patients have been warned that they have certain serious physical defects, and if we do not take into consideration these facts that are disclosed to us, we are negligent in our duty. I have in mind a case in which a patient was sent by a dermatologist to a specialist for the removal of three or four anterior teeth. This man had a large tumor mass in the mouth which was being treated and the physician wished to get a better view of the tumor through removal of some of the anterior teeth. The specialist, as I understand, had the same opportunity that one other man had of examining this mouth and being warned that the patient had a serious interference with his breathing functions. It is easy enough to understand that if a man has a large tumor mass almost completely filling the mouth, his breathing has been interfered with, and the dermatologist certainly is taking no responsibility when he says that he wishes some of these teeth removed. He assumes that the specialist taking out the teeth will use common sense and not administer a general anesthetic of any type for fear that he might suddenly be confronted with a fatality, as happened in this particular case. I see around the room men who have given nitrous oxid with oxygen for many years, and I do not underrate the warning given by Dr. Lundy, but we need not take some of his warnings too seriously. We can't carry out the ideal. As suggested, we must have the proper amount of skill, knowledge and experience before giving anesthetics; must select the anesthetic that we feel we are best able to use, and must take advantage of every opportunity to learn all we can in a practical way about our patients.

John J. Posner, New York City: Dr. Lundy stated that there is a definite death rate under nitrous oxid. To my knowledge, there is no definite death rate under procain although there is under nitrous oxid and oxygen. Dr. Lundy has approached this problem from the point of view of the medical man; Dr. Hopkinson, of the exodontist, and Dr. Heidbrink, of the general anesthetist. I should like to say something about local anesthesia, which is a subject of importance to the general practitioner of dentistry. If we administer nitrous oxid, we must have a trained assistant or must be trained ourselves. It is very difficult to secure a trained assistant, and it is just as difficult to find a dentist who knows how to administer nitrous oxid and oxygen. Local anesthesia is something which, in its nature, must be carried out by the dentist. We can send away crowns to be made, plates to be finished, bridges to be soldered and teeth to be extracted, and we can have almost everything done, including the filling of root canals, but we have to anesthetize the patient ourselves. This brings up the question of the aggravating condition of dentistry today as regards the use of local anesthetics as it is still taught throughout the United States and in many dental colleges. We are compelled to know how to do everything that we need not do ourselves, yet we are never asked to pass an examination as to whether we can successfully inject an anesthetic, which is the basis of conservative dentistry, and something which is absolutely essential. It isn't a question of painless dentistry. It is a question as to whether we can practice ordinary dentistry in a competent manner when an anesthetic is demanded. As for local anesthetics, some men believe that nitrous oxid is indicated in those cases in which one has attempted an extraction, has broken off the crown and has left in a couple of roots. He says, "In this case, you must have nitrous oxid in order to have these apices removed," and refers the case to an exodontist. The great value of local anesthesia is this, that when we have extracted the tooth, we can calmly trim the alveolar process, remove the spiculae of bone, suture the soft tissues if necessary and do many of the things which follow the removal of the tooth, which is often the thing of least importance. Local anesthesia gives

us time to operate quietly and comfortably. It is a difficult thing to take a patient's pulse when he comes in to have some work done in a dental office. His pulse is probably very fast. The majority of dentists use a large amount of epinephrin, which increases the blood pressure, a source of danger. For several years, I have been using a solution which I believe was introduced by Dr. Kells, containing one and one-half parts of epinephrin. I have seldom seen a patient suffer or show any change from ordinary calmness on injecting such a solution of procain. It is safe, does not affect the blood pressure and does not produce dry socket; in fact, does not bother the patient in the least. When Dr. Posner tells us that if one or the other of these substances is to be used, it should be procain, I say that it is a crime against dentistry if we do not know how to administer it. Fifteen years ago, when I was a senior in college, I never saw a hypodermic syringe, and the surgery faculty was standing about watching Fischer give the injection for the first time, although in 1884, an American, William Stewart Halsted, of Johns Hopkins University, had successfully made a mandibular injection. We can take everything of local anesthesia that we ever learned at college and that we have ever picked up from any book and discard it, and we will get along just as well, if we remember that there is no place in general dentistry for the infraorbital, for the tuberosity, for the second division block, for the mental injection or even the mandibular injection as it has been taught. There is no place in dentistry for subperiosteal injections, for intraseptal injections, for intraosseous injections, no place at all. Discard them. Substitute the supraperiosteal injection in the upper jaw, a straight line mandibular injection in the lower jaw. The difficulty has been that we have been foolishly depending on obsolete scientific, high sounding useless impedimenta which have been handed down like old family heirlooms that are worthless.

J. W. Seybold, Denver, Colo.: Proper preoperative preparation of the patient is essential. In the hospitals, we do not attempt to administer an anesthetic without preoperative preparation. Why? Because we then bring that patient to operation more calmly. We do not have to literally drown our patients with an anesthetic. That is not scientific anesthesia. We should prepare them for dentistry, at least mentally, by getting their confidence. Using something like barbital or similar preparations is a good thing. High blood pressure is due to excitement and to asphyxia. Many dentists do not realize that when the patient goes into the hysterical condition, high blood pressure is present. Excitement brings on high blood pressure, a condition not permissible with any anesthetic. Last year, I had my thyroid removed. As I was toxic and considered a very bad risk, I made up my mind to be operated on under local anesthesia. I had seen my surgeon operate under local anesthesia and considered him a good man, and yet I shook that bed for two hours after coming back to the room as a result of mental shock and I now give my patients what they demand. I don't insist that they have a general anesthetic if they are deathly afraid of it, because I do not wish to produce mental shock. They get what they desire. I prefer that they go to sleep, because I believe that they improve faster, that the tissues will heal faster and that the patient is altogether better off. I believe that carbon dioxid should be used in certain cases, because patients who are mentally depressed and frightened breathe like a bird, and carbon dioxid will deepen respiration.

F. E. Jeffrey, Salem, Mass.: I would like to ask Dr. Lundy one question. Consider the average dentist's office in a small city which has 25 miles surrounding it to be attended to, somewhat like an emergency ward of a hospital or an accident ward. The cases come in quickly; the patients are suffering and have to be attended to at once, and we do not get any chance to make much of an examination. Even if they are bleeders, and we know that they are, we have to take out the tooth just the same. After thirty years in practice and nine years in the practice of exodontia, I could say that nothing untoward ever happened to me until last year, when I was unfortunate enough to have a fatality. We knew the patient had bad heart trouble. The physicians had to be called to see her so many times that they took it as a joke. Her doctor, when sent for in this emergency, did not consider it serious. She had an abscessed molar, not a difficult extraction. I used about 1 c.c. of procain, with one-half the usual amount of epinephrin, 0.00002 instead of 0.00004, the standard amount, and removed the tooth, and she laughed and talked, for about fifteen or

twenty minutes, until she got ready to leave the office, when I noticed she was a little bit unsteady, and I asked her to come back and rest. She died in the office three hours afterwards. Her family physician when I telephoned him did not take the matter seriously. On account of this woman's condition, I would not consent to taking out her tooth until her physician made an examination. He just looked at her casually and said, "Have it out by all means." He had been her family physician for years, and so we took the tooth out. When I telephoned him, he said, "Let her lie on the couch for an hour and she will be all right." Fortunately, we did not have to have a coroner because the physician was there when she passed away from acute dilatation of the heart. In this case the patient's husband was with her. The family expected that this might happen, and so held nothing against me. In fact, the family are all good friends of mine now.

Victor Frank, Philadelphia, Pa.: I have been fortunate enough not to have a death in my office as the result of anesthesia, but I wish to cite an incident in the city of Philadelphia of a death that apparently resulted from procain injection. The patient, a woman of 45, had a tooth extracted with procain. As the dentist was a general practitioner with no facilities for after-care, the patient was dismissed. One hour later, she died. As she died in her home, this was apparently an accidental death. The coroner decided that it was an accidental death, and the matter was quieted. There is no doubt in my mind and in the dentist's mind that the extraction of the tooth and possibly the procain injection had a great deal to do with this death, although this is probably one of many deaths that will never appear in statistics or appear on the records against dentistry as occurring through the use of a procain injection. Here I recall a definition that was given to me some time ago as regards knowledge, skill and wisdom: Knowledge is knowing what to do; skill is knowing how to do it, and wisdom is applying both. A lot of us have the knowledge and the skill, and the wisdom regarding the technic of anesthesia comes in the application of this knowledge and skill, to each particular case. If it is at all possible to present Dr. Lundy's suggestion in the form of a motion before this Section, I would like to do it at this time, namely, that we have the A. D. A. standardize the questions and suggestions that should be asked a patient before the taking of an anesthetic.

PRESENT STATUS OF THE PULPLESS TOOTH FROM THE GENERAL PRACTITIONER'S POINT OF VIEW*

By U. GARFIELD RICKERT, A.M., D.D.S., Ann Arbor, Mich.

As recently as ten or fifteen years ago, the outstanding questions before the dental profession, other than the causes and control of dental caries, were: 1. Are all pulpless teeth a menace to the health of the patient? 2. Can surgical procedures be developed for the management of such teeth without jeopardizing the general health? A great many experimental and clinical studies have been carried on which have not only advanced the problem to newer concepts equally important, but have also indicated that, if certain fundamentals are met with adequate root surgery, root-filled teeth may be retained with safety.

In fact, it is my opinion that it is seldom necessary to extract single rooted teeth that are of strategic importance. The operative procedures that we now

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

have are not too difficult nor technical in the anterior teeth to fall within the reach of any painstaking operator who desires to engage in practice. Electrosterilization and root resection have greatly extended the possibilities of root surgery. Cases too involved to be managed through the simpler methods usually yield to one or the other of these measures.

We wish it clearly understood that we do not consider teeth of strategic importance in patients past middle age, who already may have too many pulpless teeth. It should also be thoroughly understood that only in the exceptional case would we consider pulp extirpation for the improvement of functional stability justifiable. The multirooted teeth, provided the same fundamentals are met, can also be successfully managed; but the structure and lesser freedom of access frequently make the attainment of fundamentals much more difficult in this group.

In the present stage of development of root surgery methods, extraction of molars is certainly more frequently indicated than extraction of single rooted teeth. Fortunately, since third molars are seldom of sufficient importance to require root surgery, only eight or ten of the entire complement of teeth remain which still are frequently unmanageable by the newer methods.

About a year and a half ago, a number of us who were investigating this subject in the several schools placed our information on the table. There was, happily, a general agreement that the operation ranked well in success with those of other departments of surgery, provided the present methods were satisfactorily met with fundamentals quite well established by experimental and clinical experience.

There were some slight differences of opinion as to the best operative measures for meeting the requirements. The most distinct difference one discovers in a study of individual methods is the type of filling materials best suited to the different operators. Fortunately, this is a matter of minor importance, because we are, at the present time, most concerned about the general agreement as to the possibility of the operation. For further details of the technical procedures, readers are referred to the original contribution.[1]

There are many investigators who were not contributors to the above mentioned symposium, but who should have been. Their experience, as evidenced from the literature and private conferences, are quite identical with the experiences of the above mentioned writers. We refer especially to the work of Dr. Johnson of Atlanta, Drs. Walker and Adams of New York City, Dr. Groves of Minneapolis, Dr. Buckley of Los Angeles and Dr. Murray of Denver. The question, then, with those who have devoted much time and study to the subject, is no longer, "Is the operation possible?" but, as I personally see it, "Do the dentists want to do it?"

With the assistance of grants from the research funds of the A. D. A., we have devoted a considerable amount of time and study to this problem. Soon after beginning this investigation, we came to the conclusion that, rather than have our findings buried in the literature, it was obligatory that we present our experimental results directly to interested dental organizations when requested to do so. We believed that close contact with the profession that we were to serve was

1. Hatton, E. H.; Marshall, J. A.; Rickert, U. G.; Blayney, J. R., and Hall, E. M. Dent. Cosmos, 70:249 (March), 380 (April) 1928.

essential to a clear conception of the most vital dental problems. This is, also, one way the research worker may avoid following the many interesting leads that would carry him too far afield from the immediate problem under investigation.

Then, too, we realized that there was a marked distinction between experimental data and clinical substantiation. With all due respect to experimental data and its importance in the development of technical methods, extensive clinical experience is, and always will be, the final test of any practice or surgical procedure. While we believe that dentistry, if it is to exist as a real profession, must eventually make its contributions to pure science, for the present the limited available funds should be applied only to investigation of our most urgent problems.

The more direct contact with the general practitioners in various parts of the country permitted me to have my experimental results tested by the actual clinical experience of many operators, and served also to keep me more familiar with the changing tendencies in the front ranks of dental practices. While the clinical application of our findings by many operators proved very encouraging on the one hand, in the opinion of many dentists the changing economic conditions within the profession itself, coupled with other influences, seem to have lessened the feasibility of root surgery. The future acceptance or rejection of this operation will be determined more by the mass psychology of the profession as controlled by various other influences than by future experimental studies.

PRESENT STATUS OF THE PULPLESS TOOTH

We will first review the concepts relative to the pulpless tooth in which there is quite common agreement: The general practitioners, with few exceptions, are fully conscious of the potential menace of periapical infections; recognizing that there are a large number of secondary involvements that may be initiated through these infections. They are aware, too, of the fact that some patients are less susceptible to the secondary effects than others; that there is in general an increased tolerance in youth, and, finally, that there is still quite general agreement that, under favorable conditions, pulps may be removed and, through adequate root surgery, need not become a menace to the health of the patient.

One may well ask, then, why, if it is rather generally accepted that suitable root surgery is a comparatively safe procedure, so many operators have practically discontinued the practice. There are many reasons for this, such as the intuitive feeling, based in part on conflicting experimental data, that success still depends on too many undetermined factors. There is also a suspicion that technics as outlined more or less empirically, even by some of the most recent specialists, are still involved with unessential details and buncombe, which makes the operation too tedious and uncertain. The knowledge that, in a few cases, even the life of the patients might be endangered developed some conscientious objectors.

The economic aspect is the most common reason given by individual members of the profession for the decline of the practice. I have asked many operators in what way the problem was an economic one with them, and was told that their patients could not afford the de luxe root surgery that the present day specialists advocated. On further inquiry as to what they actually did in these cases, I was told that the teeth were usually

extracted and restorations made with bridges or some other prosthetic appliances.

It does then appear to be an economic problem, but it becomes evident that this solution of the problem is planned to meet the economic situation of the dentist rather than that of the patient, for most assuredly, with our present debunked methods, root surgery of the single-rooted teeth at least should cost the patient less than the required restoration, and in the majority of cases, if properly managed, will be equally safe and more efficient and will give the patient longer unimpaired health service. Involvement of the general health and loss of the teeth because of ill-advised restorations are already approximating too closely for the best interests of dentistry the tragedies resulting from inadequate root fillings. One is inclined to suspect that root surgery would become more popular again if some way could be found of wrapping our patients in small packages and sending them away to the dental laboratories.

VITAL PULP DEGENERATION

Vital pulp degeneration, to those of us who have made a special study of the subject, is becoming a most perplexing problem. In fact, as I am writing this very page, a letter accompanied with case history and roentgenograms is placed on my desk, in which the referring dentist suspects infective degeneration of the pulp. While I believe him to be right, I frankly admit that it is impossible for me to even attempt diagnosis from the roentgenogram alone.

The last patient that I examined in my office today had a vital pulp degeneration under a fixed bridge. The restoration itself was a work of art. The patient resents the loss of the bridge, which has been made less than a year, and insists that she has not yet forgotten the fee paid for it, so we are making a desperate effort to preserve the pulp for awhile. We are aware though that only a very small percentage of these cases yield to palliative treatment. We suspect that the bridgeworker, who is an avowed 100 per cent vitalist, will be very agreeable to my pulp devitalization in this case, at least until the patient forgets the original fee.

Vital involvements, when readily located because of slight local discomfort as in the case just cited, are easy to manage, since one has a choice between root surgery and extraction. Unfortunately, there are many cases of slow infective vital degeneration that, like the involved pulpless teeth, give no local discomfort, but do initiate serious secondary effects. Such pulps may respond to all approved vitality tests. The differential variants fall within the limits of normal teeth, so that, unlike the pulpless teeth, they are difficult to locate. It is only in the advanced stages that the roentgenogram or differential vitality readings are of any help in their detection.

Those who are interested in this subject should refer to a splendid paper by Kurt H. Thoma.[2] The enlarged sections and roentgenograms accompanying this contribution are helpful in the location of areas of advanced vital degeneration, and should be studied by every dentist. For the present, the operator in the earlier stages, before there is any evidence in the roentgenogram, is frequently compelled in serious cases to resort to the trial and error method of diagnosis, which is an extremely destructive practice.

We have repeatedly, under pressure

2. Thoma, K. H.: J. Dent. Res., 9:447 (Aug.) 1929.

from competent internists, removed one or more pulps or teeth before locating the offending member. During severe acute secondary involvement of vital pulp degeneration, there is no mistaking when the offending tooth is located. This is especially true after extraction, when the pulps may be exposed and examined by gross observations and laboratory studies.

These findings, coupled with the usual phenomenal relief of the secondary effects in from twenty-four to forty-eight hours, make the diagnosis both positive and most satisfactory. The subject is of such unusual interest that one would be delighted to cite cases; but the spectacular relief of the secondary effects, while truthful, if given as case histories, would appear so much like the testimonials published by nostrum venders that one hesitates to repeat them.

This discussion has been projected into the review to call attention to the fact that operative dentistry, with all its splendid achievement, has not, as yet, advanced to a point where the most effective and efficient service is given by extraction in all suspected cases of pulp involvement and replacement with elaborate restorations.

Then, too, it is intended to give assurance that when a patient has been referred to one by the physician on suspicion of dental infection, one cannot extract all pulpless teeth and refer the patient back to the physician with a clean bill of dental health unless he has also eliminated every vital pulp involvement. A great deal of the present misunderstanding between the two professions is due to a lack of appreciation by the dentists of the significance of vital pulp degeneration.

While we and others have proved this etiologic relationship beyond the border of theory, there is still much to be learned about it. In a sense, it places a new responsibility on dentistry. If we are determined to eliminate dental infection completely by the extraction route, there is, at present, no limit as to where extraction would end other than in the elimination of all carious and traumatized teeth.

FUNDAMENTALS IN SUCCESSFUL ROOT SURGERY

I have previously referred to fundamentals. My present reference is in no way intended to cover the subject. I shall speak rather of those fundamentals which are of first importance and which have been quite generally disregarded. We have been so determined on fighting the formidable streptococci, that we have completely overlooked equally important factors.

There is, at the present time, a lamentable lack of appreciation of the part that toxins (split proteins) play in the failures of root surgery. The organic material within the dentin and that which diffuses through the permeable end of the root from the circulation may become toxic by stasis even in the absence of infection. This change is accelerated in the presence of organisms. During the slow diffusion of these toxins through the apical end of the root, we have the beginning of insults to the vital periapical tissues, which not only traumatize such tissues to a point of greater susceptibility to infection, but also directly induce several types of tissue change determined by the general reaction of the patient and, indirectly at times, initiate secondary involvements far removed from the tooth. Any root surgery is a potential failure that permits of change sufficient to become evident in the roentgenogram. This much can be said with certainty.

Unfortunately, we do have failures that do not produce marked evidence of change in the roentgenogram. In these

cases, the operator is compelled to resort to other methods for determining the value of the operation, of which laboratory cultures are of first importance. At the present time, our experimental findings have given assurance that any technical procedure that does not reduce diffusion to a point of tolerance of the vital adjacent tissues is a failure. The ideal, of course, would be the complete arrest of diffusion, which is too ideal to be practical. If such filling material adheres to the walls of the canal and is in itself impervious to diffusion and nonirritating to the tissues, at least to a point of tissue tolerance, such materials, if properly manipulated, will reward the operator with a marked degree of success. While in the Gottlieb laboratories in Vienna a year ago, I was told that materials were being tested on laboratory animals with the hope of finding whether any substances meet the requirements of tissue tolerance. We are carrying out similar experiments. The European group were right in that the next step in root surgery must give us a knowledge of materials meeting the requirements of tissue tolerance.

The second fundamental has been so often stressed that I shall refer to it only briefly at this time. In our zeal to avoid infection, we have deluged our root canals with powerful germicides, inducing many failures. Instrumentation and medication beyond the root end other than electrosterilization should never be resorted to through the root canal. When such drastic measures are necessitated, resection is the surgery of choice. Many acute conditions have been induced because operators have disregarded this fact. They have also been initiated when toxic material within the root canal has been forced into the periapical area and, by overinstrumentation, has been carried through the quarantine or natural line of defense bordering the involved area.

We have also, at times, had referred by painstaking operators patients with a marked pericementitis, interpreted by the dentist as infection, when in reality it was drug irritation. A considerable number of these cases would improve immediately after the apical end of the root was aspirated and sterile saline solution applied on the dressing. With the knowledge that is now general in the profession relative to the aseptic precautions necessary, and the fundamentals that I have outlined above, and also with the recent great improvement of root canal instruments, any painstaking operator can soon learn to manage single rooted teeth successfully, if he desires to do so. Specialists can also manage the more difficult posterior teeth.

IS THERE AN URGENT NEED OF ROOT SURGERY IN GENERAL PRACTICE?

The necessity for root surgery will be relieved gradually by the increasing education of the public and by the efforts of preventive dentistry. Contrary to this uplifting influence, the scientific and the educational development of the age have introduced new conditions resulting in frequent violent pulp involvements. The ever-increasing speed with which we are traveling in modern transit and the increasing interest in athletics from the kindergarten through the university are augmenting the number of accidental traumatic pulp deaths. Since the majority of these tragedies most frequently affect the anterior teeth and occur in youth when prosthetic restorations are quite impossible, the need for a satisfactory root surgery technic becomes imperative.

With the knowledge we now have respecting the large number of secondary

effects from the presence of infected vital pulps, it becomes even more urgent that we provide a safe operable technic for the management of these cases. Even the few operators who take pride in proclaiming their hundred per cent vitality tendencies appreciate this point of view. They frequently refer for treatment young patients with pulp involvement of anterior teeth. Their honesty of purpose is made evident when one jokingly converses with them about the apparent inconsistency of their point of view with their practices. They will invariably say that their consciences just would not permit them to extract so important a tooth since the patient was young, and required only a single root filling. I am quite in sympathy with this exception to the general rule of procedure as differing from that made imperative in middle aged patients who already have too many hopelessly involved pulpless teeth.

More interesting to me was the reasoning of a prominent dentist from another state who, some time ago, wrote me for an appointment for the treatment of one of his own upper central incisors. He said in the letter, "If this were my patient, you know what I would do, I would extract; but it's my tooth!"

The most ardent root canal specialists in the present stage of development are in complete accord with the necessity for extraction of all hopelessly infected teeth. From the research point of view, we are more concerned about saving the millions of vital pulps where root surgery will be required in the future than we are about salvaging those that are already hopelessly involved. Because of the accumulating reasons cited above, one's self respect demands the development of technical procedures less destructive than promiscuous extraction. The knowledge that pulp involvement may initiate serious secondary effects is not sufficient compensation for the increase in educational requirements occasioned by our earlier hopes regarding possible solution of these problems. If we are forced to admit that the practice of dentistry shall be limited largely to the holding of roentgenograms before a light, determining the number of pulpless teeth, advising the extraction of all of them and suggesting restorations for those patients financially capable of paying for them, one may well inquire whether the time has not arrived when the whole dental educational system should be reviewed with the idea of a downward revision in years of college preparation, since laboratory technicians with but a few months' training can and admittedly do construct such restorations.

These technicians, if properly supervised, have their place in dentistry; in fact, with suitable supervision, they may be able both to relieve the economic situation of the dentists, and to bring dental service within the means of a larger number of people. But, for some reason, when I think of chain dental laboratories, I feel an urge to remind you that, at one time, the dinosauria were the mightiest of all living things, but they made the mistake of laying their eggs in the sand, to be devoured by the little foxes. The mighty dinosauria have long since disappeared, but we still have the little foxes with us.

CONCLUSION AND SUMMARY

I would not have you believe me to be afflicted with a root surgery complex, for I am only interested in the wholesome evolution of dental service, and assure you that I am voicing the sentiment of many leaders of the profession who are sensing subtle changes developing of seemingly deep concern to the future welfare

of dentistry. I have the greatest admiration for the mechanical achievements of operative dentistry, and believe that it is only when our biologic understanding more closely approximates our mechanical achievements that the public, whose respect and confidence we are avowedly courting, will look on dentistry other than as just one more ingenious way of earning a livelihood.

I appeal to you as members of a profession, who after all must determine your own fate, as to whether you believe that we can reach the heights anticipated by leaders of the recent past, if we fail to build constructively at the present time. I do not believe that all of us should become root canal specialists because we are not all temperamentally adapted to this type of surgery, but I do insist that the profession cannot afford to discourage specialization, research and study toward even more adequate surgical procedure in the management of pulp involved teeth than is to be had by promiscuous extraction, if it is thinking of real service. Should we fail with the very problem which prompted our recent phenomenal advancement, we have lost an opportunity. General medicine will then be justified in acquiring and solving the more biologic problems now in the province of dentistry. I can assure you that we, and others, have already proved beyond doubt that the restorations required following extraction frequently prove to be of as serious significance from the standpoint of health service as the poorly treated pulpless tooth.

We are not through when we have extracted only the pulpless members, because we now know that many cases of vital degeneration under large restorations have been as definitely associated with secondary involvement as the pulpless type. With this new concept, it behooves us to meet our problems one at a time, and sanely solve them.

Ten years ago, I was led to believe that the most urgent and immediate problem before he profession was as to whether a surgical technic could be developed which would safely manage pulp involved teeth. We now know that, if certain fundamental requirements are met, this operation ranks well in success with any of the other more important operations. The question, then, is no longer, "Can it be done?" It has changed to, "Do the dentists wish to do it?" It is you, not I, who must make this decision.

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DISCUSSION

Harry B. Johnston, Atlanta, Ga.: This paper sounds a clear call to our profession for better fundamental dentistry and in addition gives us several problems of importance to think and plan about. If I should criticize this paper, I would only say that its scope might be broadened. While I realize that Dr. Rickert is speaking from the point of view of the general practitioner, I believe that the posterior teeth should be included. For certainly these teeth are under the general practitioner's care as well as are the anterior teeth, and from the standpoint of efficiency, they are the most important in the mouth. The profession as a whole cannot accept a limitation that leaves out any of the incisive and masticating organs. It may be that my opinion on this subject is somewhat biased as a specialist, but for a number of years I have preached that every city of 100,000 or more should and could have a specialist in pulp canal therapy who can handle these more difficult posterior teeth for the general practitioner. Until this day comes, the profession cannot possibly render to the public the service to which they are entitled and which they are increasingly demanding. I agree with Dr. Rickert when he says, "It has become a question of, 'Do the dentists want to do it?'" I believe that to be the aggravating part of the question, for my experience has been that the majority of the general practitioners do not want to perform pulp canal operations on *any* teeth, and will not

even under pressure consent to attempt any work except on the single rooted teeth. It is only too true, as Dr. Rickert states, that they unhesitatingly condemn the posterior teeth to extraction and then fill in the spaces with a bridge or partial plate, which not only costs the patient a great deal more money but also gives him a great deal less in service and satisfaction than his own teeth would have given had the canals been properly filled and the teeth placed in a healthy and safe condition. I have had a considerable number of my brother dentists make the admission to me without apparent shame that, "There is more money in extracting them and putting in a bridge than there is in fooling with canal fillings." This point of view, of course, could be held only by those of limited vision and with small regard for the higher obligations of our profession. It is my belief that as much pressure will be brought to bear by the patients of the future as by the dentists of the present that we eliminate this highly destructive element from the practice of our profession. Even now, it can be seen that an increasing number of our patients are demanding the conservation of their pulpless teeth. As the public becomes more informed on this subject, this demand will grow and it will, before many years, bring a sufficient pressure on us from outside our ranks to force us to deal with this as it should be dealt with. The problem of vital pulp degeneration which Dr. Rickert brings up is a real one, demanding careful research on the part of those qualified to do it. It has been my experience that this type of dental disease at times enters greatly into the question of some pathologic process far removed from the mouth. As Dr. Rickert says, this is often the most difficult dental condition to diagnose. It is comparatively new and we have few diagnostic points for our guidance. Frequently, the patient must be kept under observation for months before it is possible for us to determine definitely which tooth or teeth carry these slowly degenerating and toxin forming pulps. We look to such as Dr. Rickert to give us a readier method of diagnosis for these conditions. I am wholeheartedly in agreement with Dr. Rickert in his condemnation of the use of germicides beyond the apex for the elimination of apical infection. This has been so strongly stressed for so long that it would seem no longer necessary to mention it, but such unfortunately is the case. There are literally thousands of our general practitioners who still have, or apparently have, confidence in the powers of phenol, formocresol and other substances equally destructive of tissue, in apical infection. Bacterial necrosis is as old as the race, and nature has established an excellent defense against it; but chemical necrosis is a new type of injury against which the forces of nature have not yet established adequate protection. In many of the cases referred to me by general practitioners, teeth show necrosed apical areas, the condition being caused by the use of drugs and not by bacterial action, and very frequently, in this type of case, it is more difficult to return the tooth to normal function than probably would have been true had the initial cause been bacterial instead of chemical. In my fourteen years of pulp canal work, I have found only one agent sufficiently germicidal to destroy bacteria over a considerable area and yet cause no tissue destruction, and that agent is iodin acting under the influence of the mild electric current, giving us the method known as electrosterilization, more commonly though erroneously known as ionization. This question is the most urgent one now demanding the answer of dentistry. It has been stated, and not without a considerable element of truth, that dentistry is the most destructive of the professions. How long must we have this said of us? Can we not serve our patrons by conserving the organs with which we deal instead of destroying them? True it is that often we will serve them better by the extraction of the organ, which, because of our lack of skill, we cannot place in a healthy and safe condition for them, than by retaining the tooth which is a constant menace or an actual source of infection. Until we rise to the point where the average patient can be assured of safe conservation instead of destruction of these organs, which increase in value with every year, we have not risen to the highest professional level, which should be the goal of every proper thinking member of our great fraternity. As Dr. Rickert so properly says in his closing paragraph, "The question then is no longer, 'Can it be done?'; it has changed to 'Do the dentists wish to do it?'"

Alfred Walker, New York City: Dr. Rickert puts this question: "Do the dentists wish to fill pulp canals?" Would it not be better to say: "Why should the dentist not fill pulp

canals?" Careful and broad study of the subject must lead to the realization that principles influencing the physiologic activities of all tissues within the circulatory area are applicable when pathologic agencies are at work. We should bear in mind the structural difference of various tissues and their relationship to each other and our efforts should be directed to meet this situation. The strategic value of a tooth should never be a factor in determining the application of conservative measures in pulp canal therapy. Obviously, it would be folly to attempt to save a pulpless tooth having no strategic value, but where, from a practical standpoint, it is desirable to save a pulpless tooth, the determining factor should be the probable response to conservative therapeutics rather than its value from a strategic standpoint. The treatment of multirooted teeth resolves itself into a question of the individual operator's skill. The same biogolic and therapeutic principles are involved as in the single-rooted teeth, and each operator must decide his own course as determined by his confidence in his ability to succeed. It is a matter of experience that as skill and judgment develop refinement in technic, increasingly successful results will follow. Dr. Main, in his discussion of Dr. Molt's paper, made a very significant statement referring to the observation that overfilled canals made a better showing roentgenographically than did underfilled canals. This is in accord with my own observations. Dr. Rickert referred to the dentist who was so reluctant to part with his own pulpless tooth. Perhaps he was influenced by the medical men, who are so wont to advise the removal of their patients' teeth but who stubbornly refuse to have their own removed.

Dr. Rickert (closing): I am sure that the general practitioners appreciate the fact that we cannot, for the best interests of dentistry, throw overboard the very problem that has stimulated our forward movement, if we expect to reach the goal that we have, for a number of years, been striving for. We have a problem to solve—not to ignore. Dr. Johnson's point is well taken when he says, "Why not extend the practice to multirooted teeth?" I believe that, as a specialist, he is right, and I am glad to learn that Dr. Johnson has become a specialist in this field. I believe the time will come when many large centers of population will support a specialist in the field of root surgery. No one could ask a practicing dentist to whom root surgery is distasteful to continue the practice and expect him to do the work as painstakingly as the operation requires, unless he is temperamentally fitted for it, and especially interested in it. This work should be left to those who like and are naturally adapted for the practice of root surgery. Let us hope that Dr. Johnson has started something that will be extended to other cities. Dr. Walker appreciates too the necessity of sanely working out this problem by less destructive measures than promiscuous extraction. I think it was he who said that some patients will ask, "Will this last me all my life?" My answer to this would be, "Much depends on how long you live." There are few dental operations that one would wish to guarantee for life. I again repeat that it is not a question of "Can it be done?" but of "Do the dentists want to do it?"

ORAL ASPECTS OF LEPROSY*

By B. M. PREJEAN, †D.D.S., Carville, La.

LEPROSY is an infectious, mildly contagious disease, the cause of which is the *Mycobacterium leprae*. The disease is characterized by disintegration of any or all body tissues by granulomatous infiltration, tending to produce local anesthesia, ulceration and deformity.

Leprosy has attracted attention from earliest times. Ancient descriptions have been found in Egypt indicating its probable existence 4600 B. C. Its origin is supposed to have been along the banks of the Nile, and early history gives proof of its widespread occurrence as early as 1500 B. C. in India, and 1600 B. C. in Persia. There is no doubt that leprosy has existed from time immemorial. Nevertheless, descriptions of the disease were inaccurate and incomplete, and it was often confounded with syphilis, psoriasis and other skin ailments.

Prof. Armauer Hansen, in 1871, succeeded in isolating the bacterium now referred to as Hansen's bacillus. His discovery was reported by him to the Medical Society of Christiania in 1874.

That leprosy exists in all parts of the world is an undisputed fact. It is most prevalent in tropical countries.

The geographic sources of the lepers in the National Leprosarium include fifty countries. The larger numbers have come from Mexico, China, Louisiana, California, New York, Texas and Florida. Four hundred and eighteen have come from Louisiana.

The incidence of leprosy among the white population of Louisiana is estimated as twice that in the negro population.

Two distinct types of leprosy are recognized: the nodular, skin or tubercular type, and the nerve or maculo-anesthetic type. When there is a combination of nerve and skin manifestations, we speak of a third type, the mixed type.

Of the total of 800 cases hospitalized, 11.0 per cent were of the nerve type; 39.1 of the skin type; 49.9 of the mixed type. Of the patients, 72.3 per cent were males and 27.7 females.

In 1900, the legislature of the State of Louisiana appropriated a sum of money for the purpose of purchasing a more convenient place for the state leper home. The property under consideration was surveyed and plans were made for the building of a leprosarium. Local protests against the moving of the leper home to a site near New Orleans soon reached such a height that, just prior to the occupation of the new site, the buildings on the plantation were all burned. The Indian Camp plantation at Carville remained the site of the state leper colony. In 1904, the colony was rebuilt with

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state funds, and it progressed satisfactorily as a state institution.

In 1916, evidence given before the committee on public health and national quarantine of the senate on a bill to provide for the care and treatment of persons afflicted with leprosy, and to prevent the spread of the disease in the United States, was published, with valuable data relating to the disease in various countries. The committee reported favorably

Fig. 1.—Leprosy, skin type, with infiltration of skin and mucous membranes progressing to ulceration.

on segregation of lepers in the United States, and, Jan. 3, 1921, the Louisiana Leper Home was purchased by the Federal Government and administered as the National Leprosarium by the U. S. Public Health Service.

Eighty Louisiana lepers were hospitalized at the time of the property transfer. Appropriations totaling $900,000 have made possible the completion of an institution for the hospitalization of 425 patients.

The National Leprosarium at Carville occupies a tract 400 acres in area and is accessible to railroad and steamboat facilities. The patients are cared for in modern, attractively built cottages, with all the facilities available for

Fig. 2.—Leprosy, mixed type, with complete blindness from corneal involvement, absorption of bone and cartilage of nose, complete loss of sensation of lower lip, diminished sensation of upper lip and ulceration of mucous membrane of mouth. There is marked absorption of the soft and hard tissues of the palate, also of the alveolar tissue on the upper anterior portion.

medical attention in a general hospital and with provisions also for religious

welfare. The cottages for patients consist of twelve private rooms, a recreation room, adequate bathing and toilet facilities and two large verandas. There are thirty-five cottages, which are heated by steam and provided with hot and cold water and electric lights, and are well ventilated.

In order that the patients may pass from one cottage to another, each building within the colony limits is connected with its neighbor by a screened, covered walk. The present hospital proper consists of four wards, set aside for male and female patients who may be suffering from advanced leprosy or intercurrent diseases. Modern facilities are available for such cases, including the following: a well-equipped surgery; a dental clinic with two operating rooms and a dental laboratory; a physiotherapy department; a neurologic department; an orthopedic department, and a clinic set aside for experimental treatment with a well-equipped laboratory maintained for routine examination as well as for research purposes.

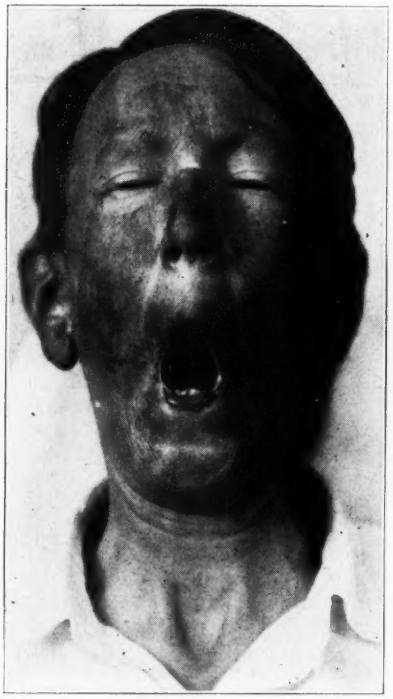

Fig. 3.—Leprosy, mixed type, with cicatricial tissue contracting the lips to form a "button hole" mouth. There is difficulty in opening the mouth due to cicatricial tissue.

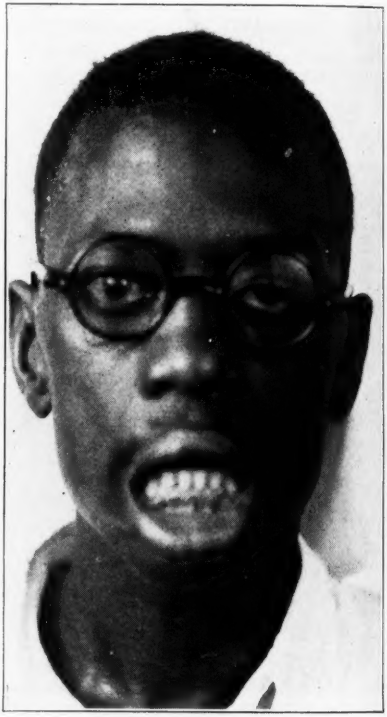

Fig. 4.—Leprosy, nerve type, with paralysis causing drooping of lower lip. There is greater paralysis on the right side of the face than on the left. The upper lip droops, covering a part of the lower teeth.

Until 1922, no serious attempt was made to introduce scientific dentistry in the leprosarium. Recognizing the necessity for dentistry, a department was organized in December, 1922; and observations made in this clinic, on oral and dental conditions furnish the data on which this paper is based.

Many oral lesions in lepers are caused specifically by the Hansen bacillus.

Nodular leprosy of the mouth is characterized by the presence of leproma (Fig. 9) and ulcerations. The nodules range in size from 0.5 to 1 c.m. They may appear alone, or in pairs, separated from each other by normal tissue. Leprous granulomas are not uncommon. The roof of the mouth in the region of the hard palate is the most frequent location. When the leproma is present in gingival margins, adjacent to lingual surfaces of the upper central incisors, its severity is increased by the accumulations of salivary calculus or other irritants, causing the tissue to hypertrophy, and covering the lingual fossa and sometimes the entire lingual surfaces of incisors.

This type of lesion, owing to its location, bleeds profusely; and the saliva becomes so viscid that it is very difficult for the patient to expectorate. Lesions appear on the outer margins of the lips, while in some of the advanced cases, large nodules have been seen on the tongue. Nodulation of gum tissue, buccally or labially adjacent to teeth, remains to be observed in this hospital.

Fig. 5.—Leprosy, mixed type, with paralysis of lower lip and extensive pyorrhea (exodontia performed later); partial paralysis of upper lip; loss of sensation of lower lip, and diminished sensation of upper lip.

Fig. 6.—Leprosy, nerve type, with total paralysis of upper lip causing drooping to approximate depth of 12 mm. In normal relation, the upper teeth cannot be seen. There is paralysis of the lower lip.

Nodules occasionally become diffused and spread toward the soft palate. Occasionally, in cases presenting a large number of leprotic areas in the mouth, the mucous membrane of the lips and cheeks becomes inflamed (Figs. 1 and 2), a condition of irritation arising so severe that, for months, little dental attention can be rendered, owing to the pain evidenced in attempting to raise the lips.

Ulcers occur chiefly on the soft palate, but occasionally on the hard palate. They appear on the mucous membrane of the cheeks in severe cases of leprosy. They have been found also on the lips, involving the entire surfaces of the orbicularis-oris muscle. When there is complete repair of the ulcers of the mouth, the tissues contract, which makes the mouth smaller. (Fig. 3.)

Fig. 7.—Leprosy, mixed type, with retrusion of upper jaw and extensive absorption of the anterior alveolar process. An upper denture was supplied.

Perforating ulcers are limited to penetration of soft tissues of the mouth. Perforation of the hard tissues has not been observed unless accompanied by syphilis. The trophic ulcer is a common lesion of the maculo-anesthetic type.

Among the oral manifestations characterizing the maculo-anesthetic type are the results of degeneration of peripheral nerves, tending to produce paralysis of the muscles of the face and mouth (Figs. 4 and 6) and loss of sensation of the mucous membrane of tongue, lips, gums and hard palate.

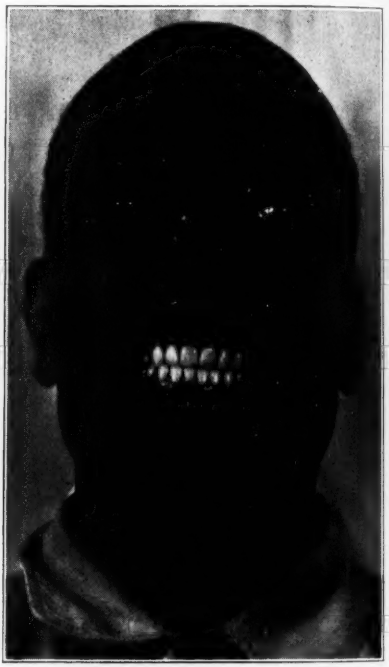

Fig. 8.—Leprosy, mixed type. There is normal occlusion with full upper and lower dentures.

In order to demonstrate the extensiveness of anesthesia from nerve destruction, I recently examined the mouths of seventy-one patients. Complete loss of sen-

sation had occurred on the mucous membrane of the right cheek in seventeen patients. Diminished sensation occurred on the mucous membrane of the right cheek in sixteen patients. Complete loss of sensation occurred on the mucous membrane of the left cheek in fifteen patients. Diminished sensation occurred on the mucous membrane of the left cheek in fourteen patients. Complete or diminished sensation occurred on the mucous membrane of the upper lip in fourteen patients. Complete or diminished sensation occurred on the mucous membrane of the lower lip in twenty-one patients. Loss of sensation on the dorsum of the tongue was present in three patients; complete loss of sensation on the right buccal gums, in two patients, and complete loss of sensation on the left buccal aspect of the gums in two cases. In twenty-three patients, there was normal sensation of tongue, lips, cheeks and gums. In one patient having syphilis, there was complete loss of sensation of the entire right surface of the hard palate and buccal gums.

Partial and complete facial paralysis in lepers occurs sometimes in the mixed and maculo-anesthetic types. It is usually bilateral. The muscles more frequently affected are those of the lips, face and soft palate; namely, the orbicularis oris, caninus, quadratus, labii superioris and inferioris, buccinator, risorius and mentalis, the muscular tissue of the palate, the azygos uvulae and the palatopharyngeus muscles and elevators of the soft palate.

Fortunately, the muscles of mastication, which are the internal and external pterygoid, the temporalis and the masseter, have not been affected by paralysis.

Gingivitis, whether chronic or acute, is present in all three types of leprosy, but it has been most frequently found in patients in whom the nodular type predominated. In six cases of gingivitis, smears stained by Ziehl-Neelson's method revealed the presence of organisms morphologically and tinctorially resembling the Hansen bacillus. Gingivitis has been chiefly observed on tissue adjacent to the six upper anterior teeth. In one case, it was confined to a minute spot the size of a pinhead, and a line of demarcation between the leprous and normal tissue could

Fig. 9.—Lepromas of gums lingually of the upper central incisors.

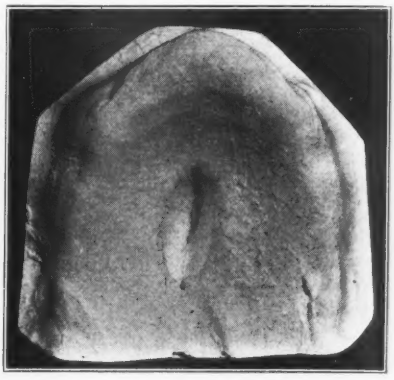

Fig. 10.—Perforation of the palatal process of the right and left maxillary bones interpreted as syphilitic.

be easily observed. The conditions have been eliminated in the six cases encountered.

Chair prophylaxis and elimination of foci of infection are of inestimable value in the treatment of lesions found in the mouth of lepers. Because of the existing hyperesthesia of some lesions in leprosy, the use of irritating dentifrices and antiseptic lotions cannot be tolerated. Mercurochrome, because of its escharotic and nonirritating properties, is ideal in lesions manifesting hypersensitiveness. Mercurochrome is being used in a 5 per cent solution as a local application and in a 2 per cent solution as a mouth wash.

The prognosis as to leprous oral lesions treated by ultraviolet rays is unfavorable in some cases and favorable in others. In some cases, the lesions are aggravated.

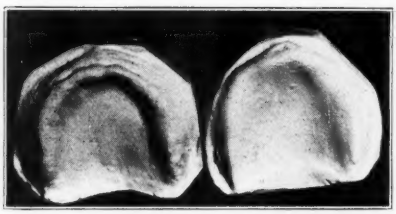

Fig. 11.—Comparative bone change. Left: Bone absorption of the alveolar process in anterior region. Right: Edentulous mouth in a patient of the maculo-anesthetic type. The view to the left, taken four years later, shows bone change in the mouth of the same patient with a line of absorption progressing in the anterior part of the alveolar ridge.

Three cases of bone perforation were observed in the mouths of lepers, all three patients having mixed leprosy. Each case showed a strongly positive Wassermann reaction. In one patient, the nodular type of leprosy predominates. The perforation is semicircular and situated on the palatal process of the left superior maxillary bone, the size being 8 mm. anteroposteriorly, and 6 mm. laterally. Pyorrhea alveolaris in the advanced stage is present, but the patient refused treatment and there was no regeneration of the mucous tissue.

In a second patient, the nodular type also predominated. There was a large perforation of the palatal process, located at the junction of the left and right maxillary bones. This condition was accompanied by considerable absorption of the alveolar process, resulting from periodontoclasia. Teeth were subsequently removed and there was considerable regeneration of mucous tissue.

In a third patient, of the maculo-anesthetic type, a perforation was present. (Fig. 10.) This was the largest of the three perforations and the most interesting. It is likewise situated on the palatal process of the left and right maxillary bones, measuring 24 mm. anteroposteriorly and 14 mm. laterally. Speech was impaired and the patient's words had a nasal twang. In eating, the food would enter the necrotic opening and exude through the nose, causing considerable discomfort. This was corrected by an

Fig. 12.—Atrophy in the anterior aspect of the alveolar ridge progressing as far as the floor of the nasal septum. (Compare Fig. 7, showing patient wearing denture.)

upper denture. The patient's speech was improved, and the perforation has reduced in size, with no evidence of osseous regeneration.

Pyorrhea alveolaris in lepers (Fig. 5) at the National Leprosarium has the same clinical symptoms as in nonlepers, with the exception that lesions have been discovered in the advanced nodular types of leprosy that were leprous in nature, and organisms morphologically resembling *Bacillus leprae* have been found in a case of dental periclasia.

It is believed that a preponderance of pyorrheal absorption as compared to that found in nonlepers has manifested itself.

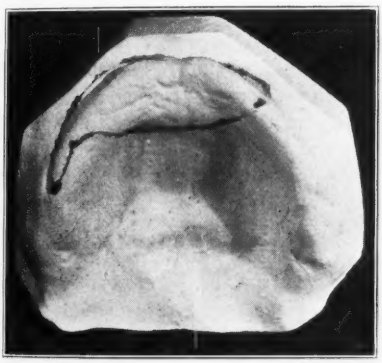

Fig. 13.—Area of recession (outlined) of alveolar tissue from gums, the soft tissues retaining their normal structure. The lesion likewise is in a patient in whom the maculo-anesthetic type predominates.

In leprosy, as in other diseases, the more advanced the systemic condition, the lower the vitality and resistance of tissues to infection. A patient having leprosy has a lowered resistance according to the progress of the disease, and intercurrent disease and infection lower his vitality, danger arising of additonal systemic disturbance through focal infection.

Bone absorption is present in some cases of mixed or anesthetic types of the disease. Unusual cases of bone change of the alveolar process of lepers have been observed in the form of a bone recession in edentulous mouths (Figs. 11 and 12), progressing as far as the floor of the nasal septum, the gums retaining their normal structure.

Many theories have been advanced as to the etiology of bone and muscular atrophy in lepers, but the general opinion is that bone and muscular atrophy are caused by constant infiltration and inflammation of the nerves, resulting in interference with nerve function.

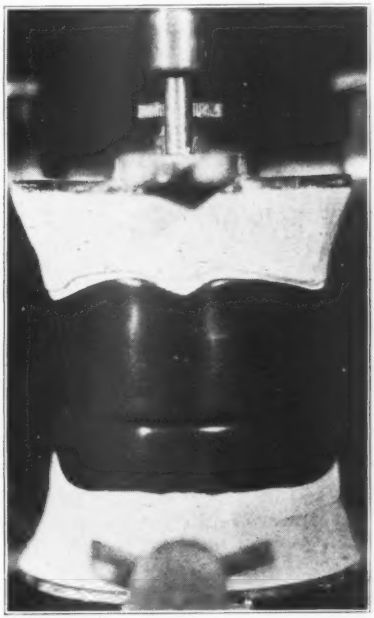

Fig. 14.—Abnormal bite reproduced in vulcanite from drooping of the upper lip caused by bilateral facial paralysis. (Not referred to in text.)

SUMMARY

Lepromas appear on the mucous membrane of the hard palate (rarely on the soft palate), and the lips, but never on the buccal or labial aspect of gums closely adjacent to teeth.

Ulcers are the results of disintegrating leproma, chiefly found in the nodular and mixed types. They never have been observed in purely anesthetic types.

Loss of sensation has occurred on the mucous membrane of the lip, hard palate, tongue, cheeks and gum tissue, in a number of patients in whom the maculo-anesthetic type predominates. The maculo-anesthetic type further results in partial or full paralysis of certain muscles of the hard and soft palate and of the mouth and lips. No paralysis has been observed involving the muscles of mastication.

It would appear that ulcers and nodules often improve and temporarily disappear without treatment. The local use of mercurochrome is of value in the treatment of leprous lesions found in the mouth.

Perforation of the maxillary bone was found in cases of the mixed type of leprosy showing a strongly positive Wassermann reaction.

Mycobacterium leprae was found associated with gingvitis in six lepers and also was associated with periodontoclasia in one case.

All three types of leprosy are affected by pyorrhea. The greatest damage occurs in cases of nodular leprosy, owing to the frequent association of mouth ulcers and leproma.

Perforating ulcers of the mouth are limited to the destruction of the soft tissues. Perforation of the hard tissues have not been observed unless accompanied by syphilis. Perforating ulcers are trophic and are common lesions of the maculo-anesthetic type.

The application of prophylaxis, miscellaneous treatment and elimination of many foci of infection have assisted in the ultimate improvement of the systemic condition in leprosy.

Tangible results have been obtained by denture construction in lepers in all three types of the disease.

Fig. 15.—Exostosis of maxillary bones in a patient having mixed leprosy. (Not referred to in text.)

WHAT IS ORTHODONTIA?*

By ALLAN G. BRODIE, D.D.S., Chicago, Ill.

IT is probably safe to say that more papers have been written under the title, "What Is Orthodontia?" than under any other in orthodontia, and the reason is not hard to find. Any man who leaves dentistry for orthodontia and seriously studies this fascinating subject eventually experiences something in the nature of a rebirth. He finds himself looking at dental problems in a new light, and contact with general practitioners and with specialists in the other fields only makes him more acutely aware of the change in his point of view. He is so surprised that he feels called on to tell of his experience, and most of these papers have been expositions of the orthodontic background. This paper is just another to be added to the list. Its purpose will be to contrast the orthodontic point of view from the preparation side, with the dental outlook; and to discuss the reasons that there are differences and our problem in dealing with this state of affairs.

Like many other branches of human endeavor, the growth of orthodontia has not been an orderly development. Starting with the observation that teeth would move on the application of pressure, and concerning itself chiefly with esthetics, it quite easily and naturally drifted into an empiric state, where the ingenuity of the operator in designing appliances was considered the measure by which success was to be gaged. It was not until relapses occurred that serious students began to ask such questions as "Why do teeth move?" and "Why should they assume the positions that we call malocclusions?" Following this came the study of etiology that was to reveal the fact that teeth were not the whole problem and that the denture was made up of a vast number of parts, each of which had its bearing on the subject. This marked its emergence as a science, and the beginning of its divergence from dentistry proper. The question naturally arises, "Why was it necessary for it to diverge from dentistry?"

Whether we like to admit it or not, the dental point of view is "toothy" and mechanical. This is to be expected in view of the nature of the dentist's work. Our dental educators have all realized this and deplored it, and an effort has been made to correct it in the dental colleges by including in the curriculum such subjects as anatomy, physiology and histology. They have learned that it takes as long to train a man's hands as it does to train his head, and with so much that is new along technical lines being constantly introduced, they are hard put to give their students even this side of the science. Proportionately less time is given to scientific fundamentals, with a result that our graduates, while excellently trained for practice, have a

*Read before the Section on Orthodontia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

point of view that is necessarily warped toward the mechanical.

When this same dentist enters the realm of orthodontia, he eventually comes to realize that this point of view is the most serious obstacle in the way of his grasping the principles of this specialty. Dentistry, in its search for serviceable and efficient restorative work, has adopted precepts in all its fields which help to solve its own problems but which in few instances apply to the living denture. They are rule of thumb procedures that raise the level of average work and are based mainly on clinical results. In order to make my point clear, let me cite one or two examples.

The dental student is taught to arrange the teeth of an artificial denture so that there will always be at least three balancing points during the various excursions of the mandible. Thirty-two point articulation is considered ideal. This teaching has added immeasurably to the success of prosthetic restorations but, in nature, it is never found except after excessive wear. The average dentist considers it normal.

Again, we have the so-called anatomic articulator, designed to simulate the jaws and temporomandibular joint of man. We are told that the curve of Spee, or an equilateral triangle or a sphere of a given dimension, depending on the system taught, will bring about a definite relation of the occlusal surfaces of the teeth with the head of the condyle. Here again, we have a contribution to successful prosthetic work but a frightful misconception when it is applied to the natural denture. No one has yet been able to demonstrate the relation between any two points in the denture aside from those purely occlusal. Yet your dentally minded orthodontist advises his brother practitioners to check his cases on such an articulator.

Examples such as these could be given in every field of dentistry, and each would show that it had been introduced not as an interpretation of the laws of the living denture but as an aid to restorative or palliative measures. The fault lies in the fact that these rules come to be accepted as applying to the living denture, and this is the nature of the obstacle that the dentist has to overcome when he enters orthodontia. Orthodontia is primarily concerned with dentures that are complete in their parts and it is the problem of the orthodontist to bring these parts into harmony with each other if they have been disturbed. He must also realize that teeth are only a very small part of this problem.

Now, what is the orthodontic point of view? How must the orthodontist look at his problem? What is orthodontia?

Orthodontia has been defined as "that science that has for its object the correction of malocclusion of the teeth" (Angle). In order to understand malocclusion, we must first understand occlusion. But as we study occlusion, we find that it is not a single or a simple subject, but one that is composed of many subjects, and it becomes necessary for us to go back to beginnings in order to understand the end. A brief survey of these beginnings and their connections with occlusion would be about as follows: First and foremost, biology, the science of life; the theories of its beginnings and the laws governing its workings. Under this subject, we find cytology, the study of the cell in all of its phases and activities, its versatility, its manner of reaction and the speed of these reactions. Next, evolution, a branch of biology and one of the laws of life. This would show us the development of the special tissues and organs and would naturally include comparative odontology and the evolution of

the various animal dentures in response to environment and function. This field is rich in material for the orthodontist and has of late been receiving a great deal of attention from some of our most able investigators.

Histology would probably come next and, properly to understand this subject, physiology. These two subjects give the student an idea of the wonderful delicacy and adaptability of the tissues that he will work on and should tend to show him the manner in which Nature does her work. The physiology of the various tissues, such as bone, muscle, connective tissue proper, and nerves, must now be tied up with our anatomy and with our comparative studies, in order that we may see the denture as a working unit and that we may understand something of the relation that each part bears to every other.

And even now we are not finished. All of this, plus embryology, is on the hereditary side of the ledger. Now we must examine the rôle that environment plays in bringing this denture to its highest state of development. Here, we are forced to dig deeply into general anatomy and physiology that we may see our denture as an integral part of a head and body and realize that it bears definite though undiscovered relations to these. It is here that our student orthodontist begins to grasp the significance of the various forces of occlusion and to visualize the ideal of the line of occlusion. The whole picture is found to be one of balance, and this balance contributes to occlusion and occlusion contributes to this balance.

With this picture or concept before him, the student is in a position, for the first time, to see that if any of these various factors or forces is caused to assume either more or less than its share of responsibility, the whole balance is disturbed, and we are on the verge of a malocclusion.

You are no doubt saying that all of this theory is given in the dental course, and that is true. True also is the fact that it is never tied up with practical work so that it becomes available for use, and the majority of dental students regard it as something to be checked off at the earliest possible minute; and he seldom takes it into practice with him. He continues to think in terms of teeth, extractions, replacements, etc., and in the rule of thumb methods covering the treatment of these conditions, which is to be expected when we consider that he is dealing with these things constantly. Your orthodontist, on the other hand, has constant need of his scientific fundamentals, and they should become bread-and-butter subjects to him. This they do not always do, of course. We will always have the rule of thumb man with us, and he will prescribe muscle exercises without knowing his anatomy, and diet without more than a very superficial knowledge of this subject. But this does not alter the fact that the orthodontist needs his fundamentals to a much greater degree than does the dentist, and he must be able to think abstractly and to reason on these things. They are his only hope of salvation.

This denture that we are asked to mold is a living, changing thing; it is not the stable, fixed machine that many conceive it to be. The prime duty of the orthodontist is to understand it; its growth and development, its makeup, its balance and its tendencies. Not until he has this conception is he in a position to practice the specialty successfully, and in order that he may arrive at this point, he must make a radical mental readjustment in his point of view.

Dentistry, although the parent of orthodontia, does not understand its own child. Orthodontic education and departments are the thorns in the sides of our dental educators, as any of them will admit. The points of view of the two professions have become so radically different that only a very superficial course is given in most dental schools, and the most recent graduates are quite frank in admitting that orthodontia is the one field of dentistry that they have not the slightest knowledge of.

This paper is not to be interpreted as a criticism of dental education or of the dental point of view. I am convinced that the American dentist is the finest trained man in this field in the world and that he is filling his position in society admirably. But I do insist that orthodontia holds a different point of view of its own problems, and I have tried to indicate the nature of this difference.

The question naturally arises, Can these two points of view be brought to a common focus? On this point, opinions vary. It is a most important question and one which is finally receiving some serious consideration. It is not at all improbable that something of the sort could be attained, but such an arrangement would be too uneconomic to be of any advantage.

To date, dentistry has been in command, but the dental point of view on orthodontia has fallen so far behind the specialty that the two talk different languages. Dentistry as it is now organized lays a good foundation for the practice of all of the specialties except orthodontia, and yet insists that orthodontia is an integral part of itself. This is not fair to orthodontia, to the dental graduate who does not even learn of its possibilities or to the man who unwittingly decides to specialize in this field. Both of the latter are very apt to be drawn into embarrassing positions through their ignorance of the fact that orthodontia cannot be properly understood through the eyes of a dentist. Mute testimony of the truth of this statement is offered by the multitude of cases the care of which is started by the general practitioner and by the superficially trained orthodontist, only to be given up, with chagrin on the part of the operator and loss of confidence on the part of the patient.

No one can say what the future has in store for this science, but it seems that our prime need at present is a stressing of the point that orthodontia cannot be viewed in the same light as is general dentistry, and orthodontic success and progress can never follow anything but a purely scientific preparation. The methods of dentistry will not prevail in this field, and we are being remiss in our duty if we do not proclaim this fact.

I feel rather guilty in bringing such a trite subject to your attention. I know I have given you nothing that you do not already know, but things that are constantly with us tend to become accepted as evils that must be borne, and they gradually pass out of our consciousness. My object has been to jar some of these latent thoughts into activity.

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THE USE OF GOLD FOIL: A SIMPLE, TIME SAVING METHOD, NOT REQUIRING UNUSUAL SKILL*

By R. W. RULE, D.D.S., San Francisco, Calif.

"THERE is nothing new under the sun." This quotation from the book of Ecclesiastes evidently refers to things on earth; yet Edison is quoted as saying: "We do not know the millionth of one per cent about anything." Doubtless both of these statements are true in the sense in which they were intended.

Many times in the past twenty-two years, my thoughts have turned back to the first article[1] published on the cast inlay, in which Taggart described his new method. I have wondered why thinking men in the dental profession had almost or entirely discarded the use of gold foil. Others, too, men in the front ranks of our profession, have given thought to this question and varied have been the answers.[2] For the most part, they have not been convincing.

The value of gold foil as a material for saving teeth has never been questioned. Even the strongest advocates of the cast inlay concede the superior value of gold foil in certain types of work. Yet how can we reconcile this with the very general unpopularity of the gold foil operation during the past two decades?

One is almost convinced that the use of gold foil would have been lost to the profession before now had it not been for the untiring, unselfish way in which Wedelstaedt, Searl, Woodbury and a few staunch supporters took up and carried on the work of G. V. Black, who so ably systematized and set forth the fundamentals of cavity preparation and the principles and methods of using gold foil. A few men, men of principle, knowing so well its virtues, have been unwilling to give it up.

For twenty years or more, the interest in gold foil work has been almost entirely sectional. An able man here and there, enthusiastic over its value, has gathered around himself a few earnest followers, and they have held to the old principles. But for these men, its use would have become a lost art. Study clubs were formed, some of which have been nation wide in their influence. With earnestness of purpose, these groups of men have devoted themselves to the use of gold foil and to development in its technic, building upon Black's foundation and making their influence felt as they could.

During the past two or three years, a good many articles have been published advocating and showing a trend toward a return to the use of gold foil in restora-

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 8, 1929.

1. Taggart, W. H.: Dent. Cosmos, 49:1117 (Nov.) 1907.

2. Rule, R. W.: Plea for the Return of the Gold Foil Restoration, Pacific Dent. Gaz., 35:50 (Jan.) 1927.

tions where it is specially indicated. One cannot speak for the country in general, but in our western meetings, the fruit of our labors is beginning to be manifest in a decided change at our conventions. It is but a few years since the gold foil clinician received only the passing glances of spectators, who went on to more spectacular things.

Not since 1900 have I seen so great an interest in gold foil work at a dental meeting as was manifested last July at the Pacific Coast Dental Conference, at which more than 1,200 practicing dentists were registered. The interest was shown both in the chair operations and in table clinics, where demonstrations were made on plaster models and extracted teeth. About thirty men were engaged in giving such demonstrations and all had a good hearing, many questions being asked and a keen interest shown. There was a demand for literature and written instruction which could not be met. These things are mentioned only to show that earnest efforts are at last having their effect, and many men are realizing that a mistake has been made in giving up the use of gold foil.

And now may we ask again, "Why was it given up?" Primarily because the best technic of handling it has not been understood or mastered. Prior to the publishing of G. V. Black's teachings on this subject, the making of gold foil operations was to the average dentist an arduous task, only to be resorted to because there was nothing that could well take its place. A comparatively small number of operators of native ability and cleverness seemed intuitively to grasp the principles involved in its use in such a way as to handle it with relative ease. Others of less resourcefuless struggled along, making the best of a bad job, ready to turn eagerly to anything that offered even a fair promise to take its place.

Black's teachings, sound and well set forth as they were, met with opposition, and were slow to be received by the profession. They required able and energetic demonstrators and teachers to establish them. In the meantime, the silicate cements and the cast gold inlay were introduced, each offering a substitute which could be handled with comparative ease or with less skill, and gold foil well nigh heard its death knell. As a matter of fact, when either the cast inlay or silicate cement is used with less skill and judgment than are required for excellent foil operations, they are more than likely to prove a failure. Moreover, the skill developed by well-directed efforts with gold foil will help materially toward better work in all operative lines.

Today, we can offer a method and technic for handling gold foil which, in small and medium cavities, where it can be used best by the average operator, will not only compete with the cast inlay, but will also enable us to do better work in less time, without undue strain on the patient, and without being burdensome or overtiring to the operator, to say nothing of the fact that sound principle and honesty of purpose demand that we use the material which will give the best results in each particular case.

To obtain these results, it is only necessary that one acquaint himself with the technic and devote a reasonable length of time to perfecting himself in it, which is certainly not more than is required for making satisfactory inlays.

Some will object to the necessity for the use of the rubber dam. We believe any valid objection can be overcome. We must study the principles involved and do a little thinking while we work; select the best punch and forceps, and the

proper clamps; choose the best quality, medium-weight dark colored dam; use a Woodbury rubber dam napkin and rubber dam holder. We must consider the patient's comfort in passing the ligature so as not to snap it onto the gingival tissues, adjusting the clamp carefully and smoothing the napkin over the face before the rubber is stretched evenly to place by the holder. Patients will then seldom object to its use. It is seldom necessary to tie ligatures around the necks of the teeth. The routine use of the rubber will soon make its adjustment so simple a matter in most cases as to be no objection at all. The time required for its adjustment will be more than saved in the further steps of the operation. The satisfaction of having a practically sterile field in which to operate affords a sense of security and peace. Failure to use the rubber dam is responsible for the infection and death of many pulps which might otherwise have been kept in a healthy state. Some operators make it general practice to use the rubber dam even for inlay operations and use every reasonable precaution to prevent saliva from coming in contact with freshly cut dentinal tubules.

Time does not permit of going into detail as to the technic of placing gold foil in all classes of cavities, and I have therefore chosen to confine myself to a description of Class I cases, chiefly those in which the grooves of the molars are involved.

In very small cavities, a few pellets of cohesive gold wedged between the cavity walls and built up to restore the occlusal form are all that is necessary.

In medium and large cavities, the use of noncohesive cylinders decidedly simplifies and shortens the operation. This is because the noncohesive foil does not become harsh and unpliable during the working of it and can therefore be readily condensed between the cavity walls with perfect adaptation, in much larger masses than could be used of the cohesive gold. As it is noncohesive, the principle of its retention and building depends entirely on wedging it between parallel or slightly undercut walls. This condition is ideally and simply met in Class I cavities.

CAVITY PREPARATION

The grooves are followed out with a No. 557 or 558 fissure bur or a No. 34 or 35 inverted cone to a point past all defect and where perfect margins can be made. Axial walls are squared up and paralleled with enamel hatchets in the lower teeth or Wedelstaedt chisels in the upper. The pulpal wall is flattened and angles are sharpened with a hoe in the angle of 12 degrees, large, medium or small according to the size of the cavity. The dentinal portion of the cavity should be made with sharp angles and box form for resistance and retention and for convenience in placing cylinders. The depth of the cavity should be just through the enamel at the bottom of the grooves unless decay has advanced beyond this. Moreover, the cavity must not be squared out at this level to any great width, lest the pulpal horns be exposed or the recessional lines cut across. The cavity should be kept as narrow as conditions will permit, and where wide extension is necessary, the pulpal horns must be circled around and left with as much protection as possible. The cavity walls and cavosurface angles having been planed and the final cleansing of the cavity attended to, we are now ready for placing the foil.

PREPARATION OF GOLD

The cylinders are prepared by the office assistant during her spare time, and a good supply of different sizes should

always be kept on hand that no time need be lost when the cavity is ready for filling.

Sheets of No. 4 noncohesive foil are cut into quarters or halves. In case of very wide or large cavities, whole sheets may be made into cylinders and used to advantage. The sheets or pieces are carefully and accurately folded into strips in the palm of the hand or on a napkin with a gold knife or thin spatula. The width of these strips should equal the desired length of cylinder. They are then formed into cylinders by being rolled on a jeweler's Swiss broach or a darning needle modified by blunting the point and grinding away the end of the eye in such a way as to leave an instrument with two little prongs at one end with a slot between them. The end of a strip of foil is placed in the slot and the remainder is rolled around the needle by turning the needle between the thumb and finger of the right hand while holding the strip against it with the forefinger of the left hand. This gives a loosely rolled cylinder which may be tightened if desired by grasping it in the center with foil pliers and folding it over double.

PLACING GOLD FOIL

With the pliers, a cylinder of the proper size and length for the cavity is placed on end on the pulpal wall, being forced back into the distal groove or against the distal wall. The length of the cylinders should be about one-fourth or one-fifth greater than the depth of the cavity so that the outer end may project enough for after-condensation. In a narrow groove, one flattened quarter sheet cylinder will be suitable. In a medium groove, two quarters side by side or one flattened half sheet cylinder may be used. In a wide groove or where decay has called for extension to a wide open cavity, two quarters may be placed and a third one wedged between them or one or more full sheet cylinders may be placed and wedged distally between the side walls. The cylinder or cylinders placed are now wedged between the buccal and lingual walls by condensing against the distal wall with a foot condenser. Hand pressure is sufficient for small cylinders, but mallet force combined with hand pressure is necessary for larger ones.

The buccal and lingual grooves are now filled in the same manner.

Condensation toward the mesial wall being necessarily back action, the simpler method of filling the mesial groove is to use small cylinders and hand pressure. The cavity will now be reduced to a smaller central area in which more cylinders should be placed against those already condensed, one end of each cylinder always resting on the pulpal wall. When the central area has been narrowed down to a small opening, a few pellets of cohesive gold should be placed here, being condensed against the pulpal wall and wedged between the walls formed by the cylinders of noncohesive gold.

The entire mass of gold should now be gone over on the occlusal surface and well condensed, the operator beginning at the center of the grooves and driving the gold toward the margins. This should be followed by burnishing the surface, always toward the margins, with quite heavy hand pressure.

The placing of the foil can be done in this manner in ordinary cavities in from five to ten minutes, scarcely more time than would be taken for making a wax pattern for an inlay. The finishing can be done in about the time required for the setting of an inlay. This is apart from the time used in casting the inlay, and the time lost through changing patients in having a second sitting for

setting the inlay, not to speak of the fact that we have better work through the perfect adaptation to the cavity walls and the water tight margins.

FINISHING

For trimming to form, we use first an ordinary round bur, No. 5 or 6, until the margins are reached. The bur should be lubricated with petrolatum (vaselin) or cocoa butter and revolved always toward the margins, running backward when indicated. It should not be too sharp, lest it "catch" in the gold and "run" on the surface of the tooth. On the other hand, it should not be dull as it would then be ineffective. The ordinary bur is preferred to a finishing bur at this stage as it cuts faster and is much less expensive. It is preferred to stones because of its more convenient size, its faster cutting and the fact that it will work right down to the margin without injuring the enamel. After this rough trimming to form, smaller round burs may be used to define the grooves, or somewhat dull inverted cone or fissure burs, or special wheel finishing burs; in fact, almost anything that suits the fancy of the individual operator. When the trimming to form is completed, the surface should be burnished, preferably with hand burnishers. The engine burnisher may be used, but does not give the same opportunity for hand pressure.

This burnishing gives a practical, durable finish, provided the condensation has been good and the trimming to form carefully done. If a smoother, better polish is desired, it can be obtained by the use of small cuttle fish disks along the margins and polishing powder carried on wood points, brushes or rubber cups.

Class II cavities should be filled with a combination of noncohesive and cohesive gold, the former being used in the gingival third or half of the proximal portion, and cohesive in the remainder of the cavity, for strength and retention. The time here for placing the foil will be from fifteen to twenty minutes for the experienced operator, and finishing, proportionately longer than for Class I cavities.

Class III cavities call for the use of all cohesive gold, but the best methods of cavity preparation and placing of foil make it practical to handle these cases from start to finish in from thirty-five minutes to one hour.

From the biscuspids forward and often in the molars, in all cases where esthetic features do not specially contraindicate its use, in Class V cavities, gold foil makes much the best restoration. Amalgam is second best. Here, noncohesive gold may be used to advantage in deep cavities, but most of these cavities can and should be kept shallow. When this is the case, cohesive gold should be used. Where esthetics demands it, baked porcelain may be used.

CONCLUSION

Some of us, perhaps most of us, long ago discontinued the use of gold foil. Have we conscientiously analyzed our reasons, and are we satisfied with the results? Are there not many cases in which gold foil operations would give our patients a better service than if some other filling material were used? In these cases, then, it should be used, and it can be used in successful competition with other materials.

Prime[3] states, in effect, that the reason we can do better work with inlays than with gold foil is that we have spent time and money and study in improving our

3. Prime, J. M.: Dent. Cosmos, 71:693 (July) 1929.

inlay technic, and have neglected our gold foil technic, and to use a Biblical phrase, "this ought ye to have done and not to leave the other undone." We believe this is a moderate statement of fact.

The advantages, then, to be gained from the use of gold foil are:

1. Perfect adaptability to the cavity walls, affording water-tight operations.

2. Compatibility with tooth structure and evenness of wear with the enamel, and sustaining power against the elasticity of the dentin, this compensating for expansion and contraction with thermal changes.

3. The possibility of making perfect margins which give continuity of tooth surface and remain unchangeable.

4. The possibilities for building to anatomic form and perfect contouring, limited only by the ability of the operator.

5. Durability surpassing that of all other materials.

6. A considerable saving of time over the inlay operation in cases of average size, and a cutting down of loss through remaking. The conscientious operator will certainly have a percentage of inlays to make over on account of defective margins.

7. The development of technical skill, which invariably accompanies its use if the principles involved have been mastered.

I therefore earnestly commend for your consideration the question as to whether as a profession we do not owe it to our patients to take up again the use of gold foil, perfecting ourselves in the technic, that we may render the highest service possible in the pursuance of the duties of our calling.

DISCUSSION

D. D. Thorn, Washington, D. C.: Dr. Rule has asked a pertinent question: Why the discontinuance of the oldest form of filling material, that, when properly handled, will give results in selected cases far superior to any other material at our disposal. I say when properly handled, and yet this does not infer difficulty of insertion or any marked degree of skill necessary for its insertion. You will all agree that certain cavities, because of the extent of the necessary restoration or the difficulty of access, are better treated with the gold inlay or amalgam, with greater comfort to the patient and ease to the operator, but, as Dr. Rule has shown, in the smaller readily accessible class of cavities, gold foil can be used and, if used in these grooves and fissures, will afford a permanent protection against the recurrence of decay, provided the proper cavity preparation has been made. The technic outlined by Dr. Rule is so clear and simple as to need no elaboration. Let me stress the value of a well-placed Class III foil filling. We have no filling superior or even equal to gold foil in this class of cavity. The silicate cements, while capable of being at times perfectly matched for esthetics, when inserted will, in the course of time, discolor; and, in all fairness to our patients and justice to ourselves, their temporary character must be recognized. It is true they may be replaced from time to time, but the loss of contact with the approximating tooth even for a short time jeopardizes the health of the interproximal tissues. The use of a gold inlay in these cases requires the cutting of more tooth structure than one feels justified in cutting; hence, my advocacy of foil for these cavities, as affording a greater protection of the tooth and the adjacent soft tissues. While Dr. Rule has limited himself somewhat to Class 1 cavities, I believe he will agree with me that in the preparation of the Class 3 cavities, the extension can be kept to the minimum, and in clean healthy mouths relatively free from decay, we would be justified in making no extension other than that required for the removal of all decay and unsupported enamel, thereby showing little or no gold. I have seen many of these small fillings giving service year in and year out without any recurrence of decay. I believe that Dr. Rule has analyzed the situation as regards the present status of gold foil operations as well as it could be done. I have never forsaken its use in my own practice. One cannot view the restorations made by some conscientious operators with gold foil, which have remained in apparently as good

condition as when they were placed from twenty to thirty and even forty years ago, without rendering homage to those good men and the filling material of their choice. In the past twenty years, there have been many changes in the practice of dentistry, due largely to the development of the casting art, and many of us have spent much of the time that we have devoted to postgraduate work in trying to keep up with these new ideas. We have learned to make new types of fixed and removable bridge attachments, new types of pontics and new single crown restorations, and we have gradually abandoned the use of gold foil. The general public's demand on us for an esthetic filling material; some manufacturers extravagant claims in regard to the durability of the silicate cements, and the blind acceptance of such claims by members of the dental profession, hoping that what they said might be true, are among the other reasons for the neglect of gold foil. I was particularly interested in one statement made by Dr. Rule: "The silicate cement and the gold inlay were introduced, each offering a substitute which could be handled with comparative ease or with less skill, and gold foil well nigh heard its death knell." In many cases, I feel that it is downright laziness that makes a man use a silicate cement where gold foil is indicated. For instance, he discovers a cavity on the distal surface of the upper left cuspid with the first bicuspid in place. He can place there a silicate cement without much effort and collect a fairly good fee for it. The fact that there will be no contact point in from three to six months does not seem to bother him a great deal, at least not enough for him to explain this to the patient and to put forth the effort to place a gold foil filling. But such a man will probably make an inferior restoration regardless of the filling material he uses. As a general rule, laziness does not help one in the practice of dentistry, but one day I was watching a friend of mine, a very able operator, and commented on his speed. He said "I am essentially a lazy man, I dislike work, and I am constantly on the lookout for short cuts, anything that will save me effort." I am sure my friend will be much interested in this technic of Dr. Rule's. He will be able to save himself the trouble of investing and casting those small gold inlays. There are few, if any, operations in dentistry which require more skill than the preparation and the filling of a Class III cavity with gold foil, and the State of New York, as most of you know, still insists on that operation as one of the requirements for the passing of its state board examination. It is my good fortune to see a great many of these operations during the course of a year, most of them performed by men just graduated from college, and some by men out in practice for varying lengths of time. I feel confident my colleagues will bear me out in the statement that we can fairly well judge a man's general ability and skill in dentistry by the manner in which he handles this operation. If, therefore, there were no other benefits to be derived from the use of gold foil than those accruing to the operator himself, in the improvement of his skill, it would be well worth while. I wish to pay a compliment to some of these recent graduates on their handling of gold foil. They reflect a great deal of credit on the men who are teaching and demonstrating this work in the colleges. I am sure, Dr. Rule, if you could have seen some of these boys work, you would have thought that the future for gold foil was indeed bright. Many of these fillings I would have been proud to claim as my own, and I have been practicing over twenty years. As I look at this question from the patient's standpoint, it is my belief that the average patient is much better satisfied to have these cavities of average size filled with gold foil and finished at one sitting than to have temporary fillings placed and return another day to have gold inlays set and polished, especially so when, as Dr. Rule has told you, it can be done so easily and expeditiously by the use of this technic which he has explained to us.

Dr. Rule (closing): Both Dr. Thorn and Dr. Atwood mentioned the Class III operation. I consider gold foil to be indicated in all classes and not confined to Class I. My reason for taking Class I was that I believe it is preeminently indicated in the majority of cases. It was necessary to confine myself in the paper to what we could cover in some detail, but I believe the class 1 operation is the easiest one to carry through and a good one to begin with. I do not quite agree with Dr. Thorn as to the question of extension in Class III operations, that is, it is not necessary in small cavities to make wide extensions. Usually, the cavity preparation can be made in such a way as to destroy little tooth struc-

ture and show little gold in the finished operation, and yet give reasonable immunity to recurrence of caries. Dr. Atwood is correct in thinking that I wished to revive an interest in gold foil. That perhaps has been the underlying desire in the writing of this paper, that it might have the effect of interesting a few of you at least in getting back to gold foil work. We know it is a fact that during recent years the student (although required to do gold foil work in the college) has almost invariably laid aside gold foil instruments as soon as he received his diploma. I have seen a good deal of the work that Dr. Atwood has spoken of in connection with students because I have been connected with college work for a number of years. I have seen students go through the course, and after completing it, be rightfully considered almost as finished operators. I have seen some of them do work that would be a credit to any man, no matter how long he has been practicing dentistry. The only difference between them and the experienced operator is that they do the work better, but take longer for it. After a little experience, they cut down the time. I have had the privilege of stimulating gold foil work in two of our western colleges in recent years by putting on a little contest. We announce to the students at the beginning of the junior year that there will be a contest in the senior year, and in order to qualify, they need to be one of the ten best operators in the class. And at the end of the senior year, those with the ten highest grades in gold foil operations are selected as having qualified for the contest. The judges are selected from the California Study Club, and they have no knowledge of the students in the college nor of their work. It was interesting to see the amount of real pleasure and interest the students took in endeavoring to perfect themselves in this work, and the results have been astonishing and most interesting to me.

INNERVATION OF THE GINGIVAE*

By D. P. MOWRY, D.D.S., L.D.S., Montreal, Canada

DURING the course of the last ten years, I have performed many thousands of the operations known as dental prophylaxis. One important physiologic reaction has always interested me: After the use of the toothbrush is demonstrated in the patient's mouth, the gums are an intense pink, indicating what is known as hyperemia. Within a very few minutes, this color fades to a pale pink. This phenomenon is, no doubt, due to a reflex action of the vasomotor nervous system. The histology textbooks give considerable information about the tissue structure of the gums and the blood supply, but there is a scarcity of information about innervation.

An important constituent of most tissues is the nervous element. No tissue in the body economy is sufficient unto itself. It is valuable in proportion as it is brought into communication with the central nervous system and thus, indirectly, into harmonious relationship with the other tissues. Impulses are carried from and to a tissue by the nerve fibers.

The stratified squamous epithelium of the gingiva is well known to histologists. Every textbook describes the layers of epithelial cells with intercellular bridges, and beneath the epithelium, the papillae

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

of connective tissue. The blood supply to the connective tissue is known, and also the nourishment of the epithelium by the lymph.

I have been curious to know whether the nerve fibers ended in the connective tissue or they penetrated beyond the basal layer of epithelial cells. Marshall[1] tells us that nerve filaments are rarely found in the gum tissue. Sorrin and Miller[2] state that blood vessels and nerves are found in the connective tissue papillae. Noyes[3] mentions that certain nerves terminate in free endings lying between the epithelial cells, but he shows no illustrations.

We have obtained results by two methods of staining: one a modification of the Ranvier and Cohnheim gold chlorid method, and the other a modification of the Bielschowsky silver nitrate method. Both technics will be given at the end of the paper.

The material for the sections here shown was in the form of crescent-shaped excisions of human gum taken at the gingival margin.

Nerve fibers, and especially nonmedullated fibrils, travel through a tissue in a circuitous manner; which makes it difficult to obtain any considerable part of a single nerve fiber on one section or in one focus. The use of selective stains, fairly thick sections (15 microns or more), and the tracing of the fiber through changing foci are three of the many essential steps in demonstrating these fibers.

Beneath the epithelium of the gum in the connective tissue are to be found

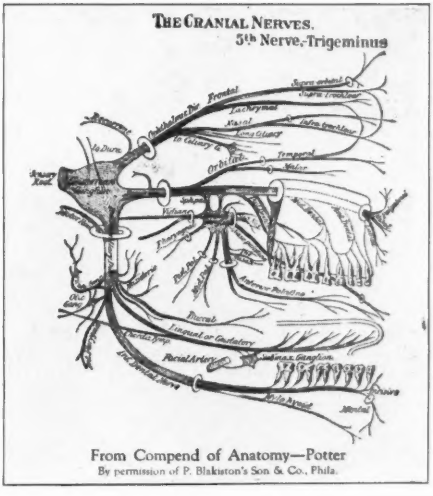

Fig. 1.—Trigeminal nerve.

1. Marshall, J. A., in Johnson, C. N.: Operative Dentistry, Philadelphia: P. Blakiston's Sons and Co., 1923.
2. Sorrin, Sidney, and Miller, S. C.: Practice of Periodontia, New York: The MacMillan Company, 1928.
3. Noyes, F. B., and Thomas, N. G.: Textbook of Dental Histology and Embryology, Philadelphia: Lea and Febiger, 1921.

nerve bundles usually associated with a blood vessel. Note the varicose appearance typical of nerve fibers and compare with nerve fibers in a section of the gasserian ganglion. (Figs. 4 and 5.)

Nonmedullated fibrils are found penetrating upward between the cells of the basement layer of the epithelium and extending irregularly toward the surface.

In examining the slides, the structure shown in Figure 11 was discovered. It is apparently what is described by Ranvier[4] as a nerve cell of Langerhans. It is interesting to note the fibrillar branches, as well as what appear as terminal knobs. Whether this is a nerve structure, a pigment cell or some form of leukocyte, I do not know, but I wish to record the finding for future investigation; to establish its nature. The fact that a selective nerve stain (gold chlorid) was used suggests that the structure is nerve tissue.

What is the application of this finding of nerve endings in the epithelium, and what practical purpose does it serve the dental practitioner? Permit me to quote from Talbot[5]: "While the nervous system has other special functions, the one great object is that of regulating growth and repair. As Marinesco has shown, this function resides even in the neuron or nerve unit. Growth and repair are regulated through the trophic and vasomotor systems."

I would propose the theory that this is another link in the chain of clinical evidence that healthy gums are to be had

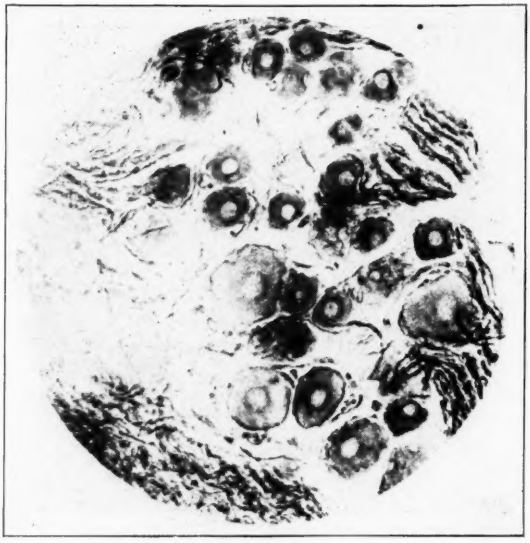

Fig. 2.—Gasserian ganglion of cat, showing nerve cells and fibers, and varicose structure of fibers. (×200.)

4. Ranvier, L.: Technisches Lehrbuch der Histologie, 1888, pp. 830-831.

5. Talbot, E. S.: Interstitial Gingivitis, Philadelphia: S. S. Dental Manufacturing Co., 1899, p. 271.

when normal function is established. The refined foods of today do not sufficiently stimulate the gums. It is therefore necessary to resort to artificial means. The toothbrush, used in such a manner that the points of the bristles scour the teeth and the sides of the bristles vigorously press and bump against the marginal gingivae, causes a stimulation of the nerve endings in the epithelium. Bainbridge and Menzies[6] (page 47) say: "... effects of stimulation of nerve are due to changes in nerve endings and not to any specific change in the nerve itself." This gives rise to impulses which pass along the superior and inferior maxillary divisions of the trigeminal nerve to the gasserian ganglion, where the stimulation is communicated to the vasodilator branches of the sympathetic system, as well as to the brain. This, in clinical experience, results in a highly resistant condition of the gum tissue, with normal tone and color."

The accompanying illustrations were prepared in the Department of Histology of McGill University, by John Partridge. Much credit is due him for the care and ability exercised in the staining technic. Dr. D. J. Bowie and Prof. J. C. Simpson have given valuable assistance and advice.

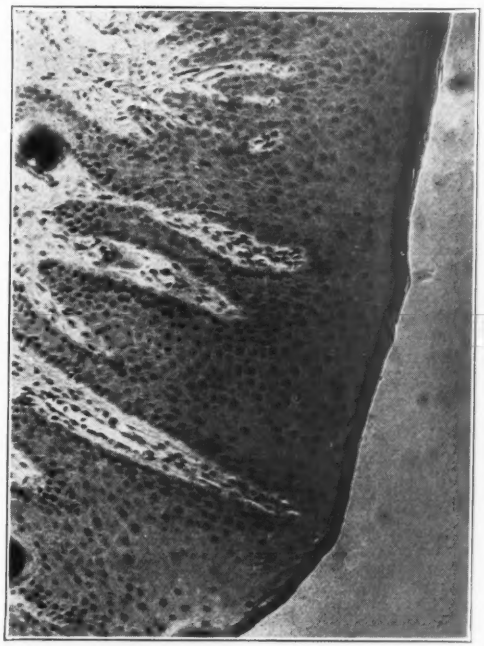

Fig. 3.—Stratified squamous epithelium of the gingiva and connective tissue papillae.

6. Bainbridge and Menzies: Essentials of Physiology.

METHOD OF STAINING

This method is a modification of Ranvier and Cohnheim's gold chlorid nerve stain.

1. A piece of fresh tissue is fixed for at

Fig. 4.—Longitudinal section of nerve bundle in connective tissue of human gum. (×300.)

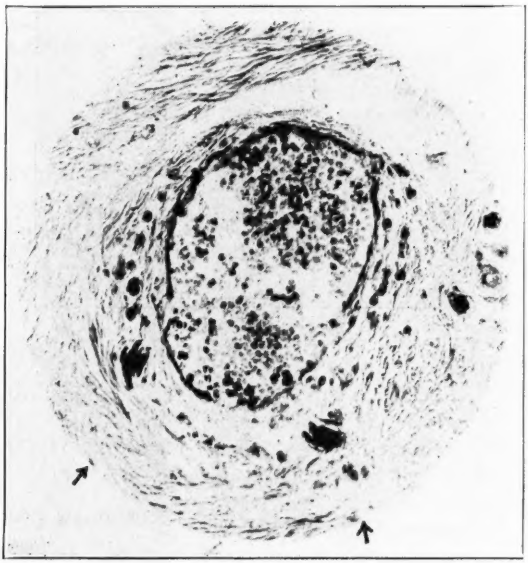

Fig. 5.—Transverse section of nerve bundles in connective tissue of human gum. (×300.)

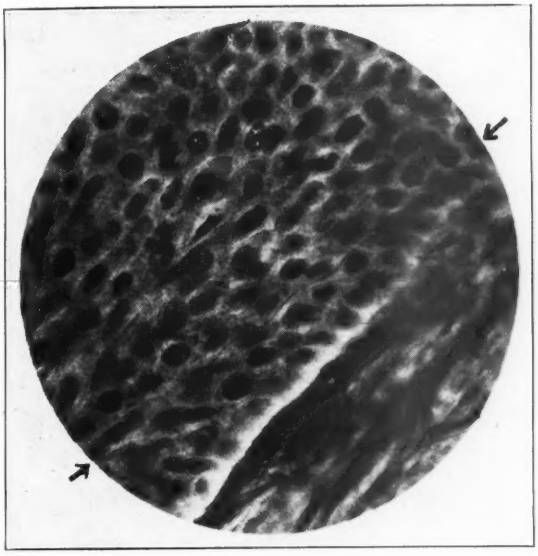

Fig. 6.—Nonmedullated nerve fiber in stratified squamous epithelium of the human gingiva.

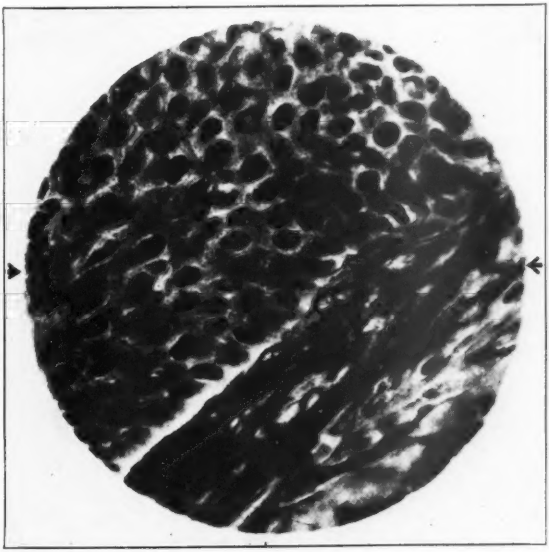

Fig. 7.—Nonmedullated nerve fiber emerging from connective tissue to penetrate between human epithelial cells.

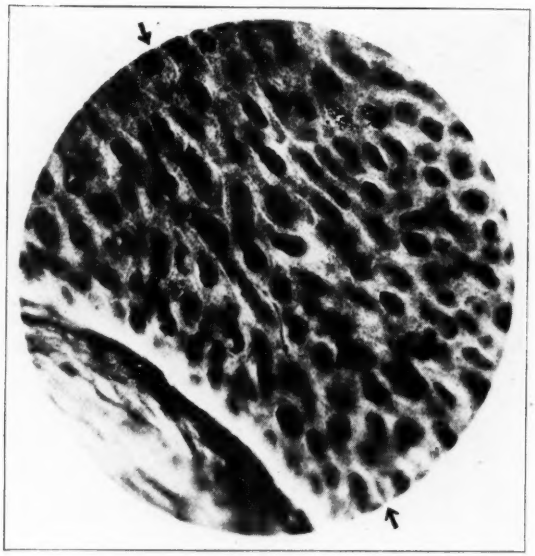

Fig. 8.—Nonmedullated nerve fiber in epithelium of human gum.

Fig. 9.—High magnification of nonmedullated nerve fiber in epithelium of human gum.

least 48 hours, in 10 per cent neutral formalin (40 per cent solution of gaseous formaldehyd).

2. The tissue is washed in distilled water for fifteen minutes, and frozen sections (15 microns) are cut and floated on distilled water.

3. The selected sections are placed in a small dish of freshly expressed and filtered juice of a lemon and left to be mordanted for ten minutes.

4. The sections are washed rapidly in distilled water and stained with a fresh 1 per cent solution of gold chlorid for one hour.

5. The sections are then transferred directly to a large quantity of acidulated water (10 c.c. of acetic acid to 250 c.c. of distilled water), and left for twenty-four hours, during which time the nerves become apparent.

6. The sections are then washed in water and differentiated for thirty seconds in 50 c.c. of a freshly prepared solution of 5 per cent sodium-thiosulphate.

7. They are then washed for two minutes in distilled water and counter-stained rapidly by dipping, and removed immediately from a concentrated solution of picric acid.

8. The sections are washed well, and rapid but thorough dehydration follows. They are then cleared in xylene and mounted in Canada balsam.

9. The nerve fibers are stained a dark purple, while other tissue is yellowish.

MODIFICATION OF BIELSCHOWSKY SILVER NITRATE STAIN[7]

1. A piece of fresh tissue, not exceeding 1 mm. in thickness, is fixed for at least forty-eight hours in 10 per cent formalin.

2. The tissue is washed in distilled water for fifteen minutes and thin frozen sections are cut and floated on distilled water.

3. The sections are placed in pure pyridin for three hours to be mordanted at 37 C., and

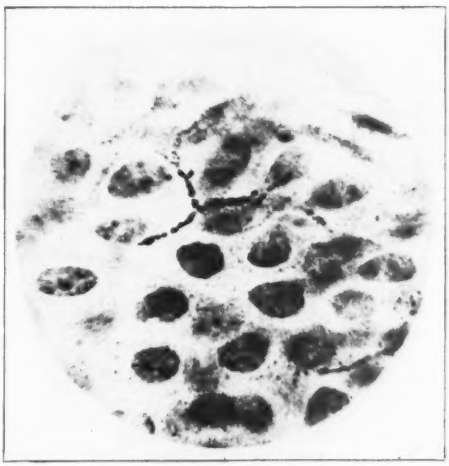

Fig. 10.—High magnification of nonmedullated nerve fiber in human gum.

washed for one hour in distilled water, to remove the odor of the pyridin.

4. Selected sections are placed in a darkly covered bottle of freshly made and filtered 2 per cent silver nitrate solution, and left for eighteen hours to be impregnated at 37 C.

5. These are then washed rapidly in distilled water and transferred for from five to fifteen minutes, to the following ammoniacal silver bath: To 5 c.c. of 10 per cent silver nitrate, add 3 drops of fresh 40 per cent sodium hydroxid, in which a precipitate will

7. Oertel, Horst: Innervation and Tumor Growth, Canad. M.A.J., 18:135 (Feb.) 1928.

form. Decant; wash the precipitate several times and add up to 20 c.c. distilled water. Redissolve the precipitate by adding ammonium hydroxid drop by drop, not exceeding 15 drops, and filter through a filter paper previously moistened with distilled water.

6. The sections are washed rapidly in distilled water and placed in 10 per cent formalin, to reduce for 10 minutes, or until the white cloud disappears and the sections turn black.

7. It is essential to filter all solutions and baths, to use glass needles and to agitate sections constantly after step 4. Wash sections well, usually about fifteen minutes after formalin reduction and differentiate in a 1 per cent solution of cyanid of potassium for from one to four minutes. (This is a very important step.)

8. The sections are then washed for two minutes in distilled water and placed in a 0.5 per cent solution of gold chlorid to which 3 drops of acetic acid has been added, for ten minutes, or until the sections turn gray.

9. The sections are now washed in water for one minute; and further reduced in 5 per cent sodium-thiosulphate; again washed well in water and counterstained very lightly with hematoxylin.

10. The sections are next dehydrated quickly in 95 per cent absolute alcohol, cleared in oil of bergamot, and mounted from xylene with Canada balsam.

Nerve fibers are stained characteristically black; other fibers and reticulum, pale brown or darkly yellowish. Where nerve and other fibers are intimately associated, careful focusing will, in properly differentiated slides, permit the distinction between them.

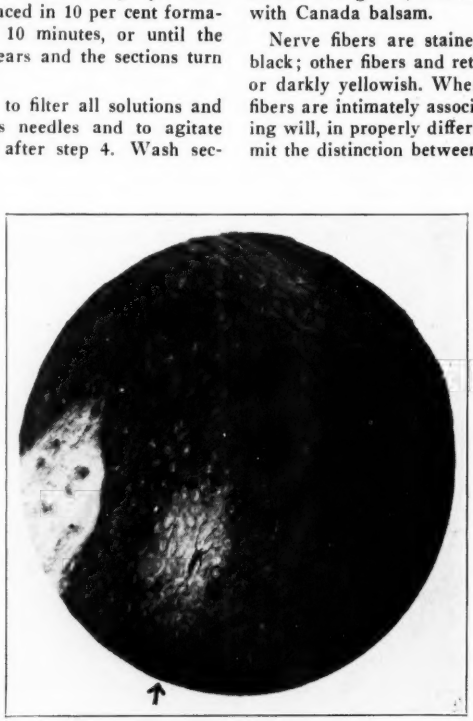

Fig. 11.—Structure in stratified squamous epithelium of human gum; probably nerve cell of Langerhans. The end knobs on fibrillar projections should be noted. (L. Ranvier: Technisches Lehrbuch der Histologie, 1888, pp. 830-831; Menschen: Handbook of Microscopic Anatomy, 1928, pp. 339-350.)

DISCUSSION

Vida A. Latham, Chicago, Ill.: Dr. Mowry deserves the greatest credit for assuming to study these tissues, for it is only by so doing that we will learn the etiology of many problems in stomatology. It is a pity that in the later years there has been a tendency to alienate the physiologist from the study of histology. The common object which the anatomist and the physiologist ought to have in view

is the elucidation of general laws governing biologic phenomena. I have always urged that research on the oral organs be undertaken in the light of the newer methods in the staining, fixing reactions. Embryology is needed to ascertain these origins, and work on the glandular structures, and added to these the vasomotor control and the lymphatics. This gives a true foundation for the many pathologic effects in gingivitis, interstitial or so-called periodontitis and pus. Internal medicine then can aid us to treat these systemic conditions. Considerable work has been done on the nerve supply, but it is scattered throughout various papers. During the studies conducted by the late E. S. Talbot and me many nerve methods were used, some being reported in *The Journal of the American Medical Association* by my laboratory assistant, Martha Anderson. *Intra vitam* methods are difficult to control, also those by injection or feeding. It is essential to carry control sections at the same time. I would suggest the sensory structures of the eye, and skin, with those of the gingivae, as these usually show some early pathologic change. Frog tissues are easy to obtain and easy to handle, being as thin as the intercostal muscles. Motor and sensory endings after careful handling show well. Fixing solutions should be isotonic with the tissues they come in contact with. There should be neither exosmosis nor endosmosis of the tissues. Formol (solution of formaldehyd in wood alcohol and water) and osmium tetroxid is combined with normal salt (physiologic sodium chlorid) solution. It is wise to study tissues and cells in different phases of functional activity, massaging, brushing, etc. With metallic stains care must be taken to avoid errors of interpretation. Some useful methods are hematein, Dogiel, Weigert, Golgi, Sihler, Kallius, Cajal, Ehrlich, H. Stroebe, von Kupffer; or for tracing nerve fibril bundles, Bethe's is a very good one if carefully done and by his directions (*Ztschr. f. wissen. Mikr.*, 17:13-35, 1900). Kromayer's gives a sharp staining of Ranvier's fibrils in stratified epithelium. Ranvier, Cohnheim, Retzius, and Boll give good results. Pal's modification of Weigert's stain is simpler and may be followed by a nuclear stain. For pathologic gum tissue, Marchi's method and Singer and Munzer's are excellent for degeneration changes, and true wallerian degeneration has been found in interstitial gingivitis, arteriosclerosis and the pulp conditions. Mallory and van Gieson's staining methods are helpful. If sections of gum are cut by the freezing method, stained by Bielschowski's method, some with iron-hematoxylin and van Gieson's stain or eosin, it is worth the time. The Bielschowski sections are afterwards reimpregnated with gold and stained with hematoxylin and eosin. Collagenous connective tissue, when paraffin and alcohol and heat are used, yields artefacts. For this reason, G. C. Heringa produced his gelatine method. (Une Nouvelle Méthode D'Inclusion a la Gelatine, *Compt. rend. d. sc. de la Soc. biol.*, 91:671, 1924).

Dr. Mowry (closing): I have in mind intravital staining by methylene blue in a cat. We hope to maintain the vitality and, while the heart is still beating, inject the methylene blue, and then immediately use the frozen sections of the gum to see whether we can get a finding there of the true nerve fibers. What I wished to do here was to initiate some interest in the nerve innervation of the epithelium, feeling convinced that the reflex action of nerve stimulation on the tissues and the blood supply there is a vital factor in maintaining the health of the gum tissue.

THUMB-SUCKING: A CAUSE OF MALOCCLUSION IN THE DECIDUOUS TEETH*

By SAMUEL J. LEWIS, D.D.S., Detroit, Mich.

THE study I am about to report was undertaken in an attempt to answer some of the perplexing questions that may be asked concerning the relation of thumb-sucking and malocclusion in the deciduous teeth. For instance: Is thumb-sucking a cause of malocclusion in the deciduous teeth? Do the textbooks and the current literature answer this question satisfactorily? Have we scientifically and biologically sound evidence to substantiate the statement that thumb-sucking does operate as a cause of a definite type of malocclusion or malformation of the deciduous teeth and dental arches?

Our knowledge of the subject to the present time has been derived almost entirely from textbooks and the literature. In neither case is there much scientific evidence given to warrant the opinions stated, and even a casual analysis of the literature reveals a wide variance of opinion both as to whether the habit causes malocclusion in the deciduous teeth, and as to the nature and extent of the malocclusion.

Angle[1] writes: "The habit of sucking the thumb . . . so frequently formed by young children, while rarely causing displacement of the deciduous teeth, will, if persisted in during the eruption of the permanent teeth, cause a marked malocclusion."

Case[2] writes: "The one cause which most often affects the normal relation of the deciduous dentures is the habit of thumb-sucking, which if allowed to continue into the early years of the secondary dentition will frequently produce all the dentofacial characteristics of an upper protrusion, but with no effect upon the distomesial relations of the buccal teeth, except to narrow the arches."

Dewey[3] writes: "Habits of childhood produce a few types of malocclusion. Thumb- and finger-sucking has long occupied a place among the etiological factors of malocclusion, but they do not produce as many malocclusions as was formerly supposed."

McCoy[4] writes: "This much heralded cause [i.e., thumb-sucking], while productive of damage if persisted in over a long period, is usually broken early and for that reason is not responsible for all the deformities frequently attributed to it." He admits the possibility of displacing the upper and lower incisors by thumb-sucking, but adds: "Such results,

*Read before the Section on Orthodontia, at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 8, 1929.

1. Angle, E. H.: Malocclusion of the Teeth, Ed. 7, Philadelphia: The S. S. White Co., 1907.

2. Case, C. S.: Dental Orthopedia and Correction of Cleft Palate, Chicago: C. S. Case Co., 1921.

3. Dewey, M. H.: Practical Orthodontia, St. Louis: C. V. Mosby Co., 1914.

4. McCoy, J. D: Applied Orthodontia, Philadelphia: Lea & Febiger, 1922.

however, necessitate the persistence of the habit in an intense degree over a period which extends well beyond babyhood."

Jackson,[5] in discussing thumb-sucking as a cause of malocclusion, writes: "This often causes a considerable space to intervene between the upper and lower incisors, but the principal permanent irregularity that results from this habit is from its continuance after the eruption of the permanent teeth."

Lischer[6] mentions thumb-sucking as a fruitful cause of malocclusion and dismisses it with the statement that it is probably the most common cause and frequently the hardest to eliminate.

That is to say, we find among the authors of the foremost books on orthodontia widely varying opinions on the effect of thumb-sucking on the teeth and dental arches; nor does any author offer evidence to prove or disprove his opinion regarding the relation of thumb-sucking

DENTAL REPORT

Please check conditions under each heading and return to the Merrill-Palmer School as soon as possible.

Brushing Teeth	Cleansing Agents	Visits to Dentist
Daily	Tooth paste	Once in 6 months .....
Morning	Tooth powder	Once a year .....
Evening	Water	Only when tooth aches .....
Does it himself		Date of last visit .....

Bad habits:

Thumb-sucking .....
Finger-sucking .....
Tongue-sucking .....
Lip-biting .....
Grinding teeth .....
Nail-biting .....
Other habits .....

Name .....
Address .....
Age ....

Date .....

Fig. 1.—Questionnaire 1.

5. Jackson, V. H.: Orthodontia and Orthopedia of the Face, Philadelphia: J. B. Lippincott Co., 1904.

6. Lischer, B. E.: Orthodontics, Philadelphia: Lea & Febiger, 1912.

In order to complete a paper on dental research it is essential that we have your immediate cooperation in answering the questions below.

Our records show that at one time or another your child . . . . . .

. . . . . .

Please place your answers next to the following questions, and if you cannot give exact dates or ages, give approximate ones.

Name of child . . . . . .

Address . . . . . .

Present age . . . . . .

At what age did you first notice habit?

When did the child indulge in the habit? (Mark following yes or no.)

1. When going to sleep.
2. During sleep.
3. Upon awakening.
4. When tired.
5. Nap-time.
6. During play.
7. When idle.
8. When hungry.

If thumb-sucking, which thumb?

If finger-sucking, which finger and which hand?

Has the habit been broken?

If so, at what age was it broken?

What means did you employ in breaking the habit?

Fig. 2.—Questionnaire 2.

and malocclusion of the deciduous teeth. The statement of Case most nearly coincides with the results of the present investigation.

Pullen[7] includes thumb-sucking under

7. Pullen, H. A.: Abnormal Habits in Relation to Malocclusion and Facial Deformities, Proc. First Internat. Orthodon. Cong., 1926.

the heading "Sucking Habits" in his classification of the habits associated with malocclusion, and observes that "the effect of the habit on the plastic tissues of the face in early childhood can be observed in many profiles." Pullen mentions the case of one child, 2½ years old, whose thumb-sucking had caused a very evident protrusion of the upper incisors,

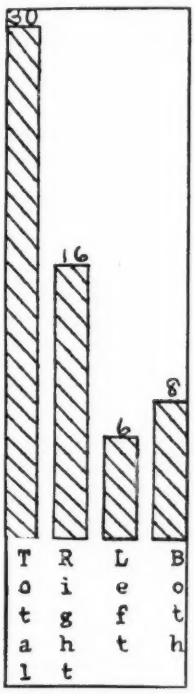

Fig. 3.—Number of cases in which the right thumb, the left thumb and both thumbs were sucked.

but thinks it encouraging that this, like certain other habits, usually disappears during childhood. He leaves the impression that little if any damage is done unless the habit persists to maturity. In the case cited, Pullen states that the habit was broken by suggestion, and that the malocclusion corrected itself without appliances. There is an illustration of a model taken before the habit was broken, but none to show the self-correction of the malocclusion.

In a discussion of habit and adaptation, Johnson[8] writes: "The phenomenon of habit is a normal manifestation of living tissue, essential to the development and functional activities of the organism. Normal habit movements help to maintain normal structural form. Abnormal habit movements are associated with abnormal structural form. Habit, then, an intrinsic force, like all natural processes, is a factor in adaptation which if perverted in its action will be as potent an influence in maladjustment and subsequent disorganization. A pernicious habit is an expression of a natural phenomenon gone wrong. Hence, in order to attack intelligently the problem of habit as a cause of malocclusion and maxillary deformity, a consideration of the normal manifestations of habit phenomena is of primary importance."

Johnson is the only one among contemporary writers on orthodontia who has attacked the problem from the biologic point of view. He does not mention any specific habit or any specific deformity resulting from it. He approaches the problem as a natural phenomenon, and, in so doing, has given us our first full treatment of habit as an etiologic factor in malocclusion of the teeth.

I cannot wholly agree with Johnson's conclusions as to the most effective means of eliminating the habits instrumental in the formation of abnormalities. He believes that we must eliminate the stimuli which initiate the primary movements;

8. Johnson, A. L.: Basic Principles of Orthodontia, Dent. Cosmos, 65:379 (April), 503 (May), 596 (June), 719 (July), 845 (Aug.), 957 (Sept.) 1923.

that is, we must maintain the teeth and the surrounding parts in as nearly their typical forms and relations as possible. What he means is the correction of the malocclusion—the correction of any and all abnormal structural conditions that may become, by their peculiar character, a stimulus to abnormal action. To use his own words, "I mean prevention." If Johnson means by prevention the correction of an already existing malocclusion, his conclusion, especially as it applies to the deciduous teeth, appears to be only partly true. The evidence gathered in the present study points to the conclusion that the real factor in the prevention of malocclusion of the deciduous teeth associated with thumb-sucking is the earliest possible elimination of the habit.

It is not my intention to enter into a discussion of the phenomena and many theories as to habit, which have been considered by so many writers better qualified for the task, but, rather, to cite the evidence which seems to offer a rational solution of this problem. It should be understood that this report is to some extent a preliminary one, and that the conclusions may be somewhat altered as the data increase, and, further, that the conclusions are based upon the study of one group of children.

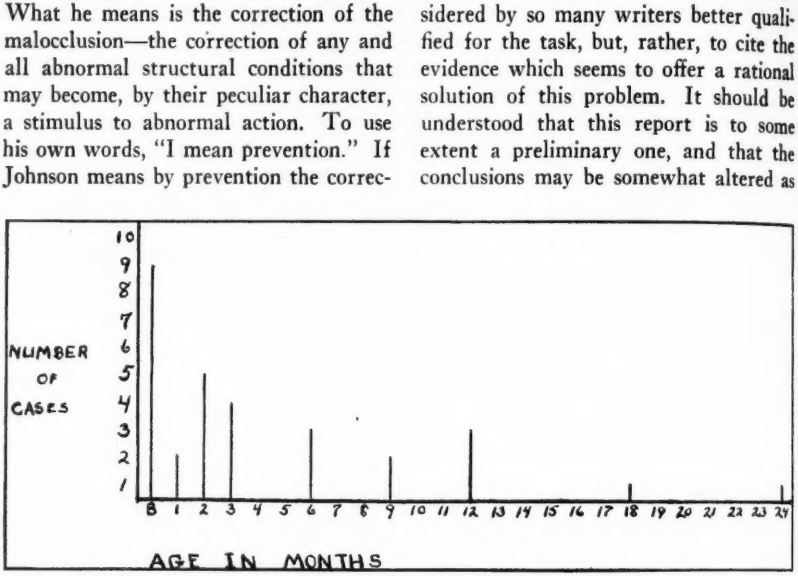

Fig. 4.—Distribution of ages at which the thumb-sucking habit was started.

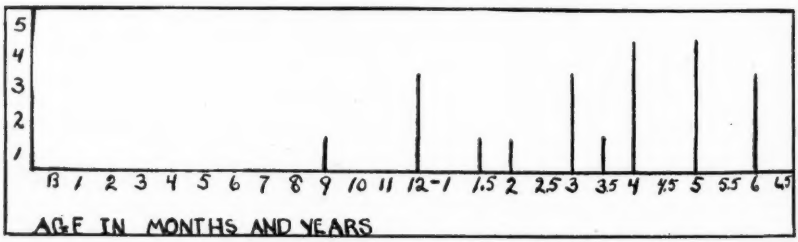

Fig. 5.—Distribution of ages at which the thumb-sucking habit was broken.

During the past five years, Ira A. Lehman and I have been observing the growth changes in the teeth and dental arches of a group of preschool children at the Merrill-Palmer School in Detroit. A report of this study has been pub-

lished.[9] In the course of that study, we found that a large number of children presented a definite history of certain undesirable habits, many of them associated with malocclusion of the teeth and deformities of the maxillae. A questionnaire (Fig. 1) was sent to the parents to corroborate our findings, and the results were checked with the report of the nursery-school teachers and our own observations, so that we had three checks. Not at all times did they agree; for, in a number of instances, the parents had either wittingly or unwittingly neglected to observe the habit.

During the course of the study on growth changes, we noted certain occlusal phenomena seemingly associated with these habits, and, accordingly, the models of these cases were set aside for further study and a second questionnaire (Fig. 2) asking for more detailed information concerning these habits, was sent to the parents. At this time, only the results of thumb-sucking, the predominant habit, will be reported. With the models made at yearly intervals, we were able to observe the effect of this habit upon the dental structures, and the questionnaires completed our information.

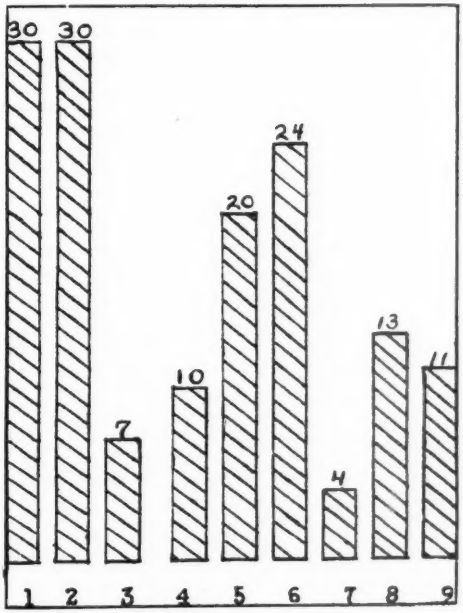

Fig. 6.—Distribution of times at which the habit was indulged in. *1*, total number of cases; *2*, going to bed; *3*, during sleep; *4*, on awakening; *5*, when tired; *6*, nap-time; *7*, during play; *8*, when idle; *9*, when hungry.

In the paper on "Observations on Growth Changes of the Teeth and Den-

9. Lewis, S. J., and Lehman, I. A.: Dent. Cosmos, 71:480 (May) 1929.

tal Arches"[9] we noted: "In thumb-sucking cases where the habit has not been broken, the resultant malocclusion remains practically static. When the habit has been broken before the fifth year, the resultant malocclusion has a tendency to correct itself." Our later data corroborate this statement.

Of 170 children who have been under observation for a period of from one to five years, seventy had a definite history of some undesirable habit. Of these, thirty presented a history of thumb-sucking. Sixteen of these thirty children sucked the right thumb; six, the left thumbs, and eight both thumbs (Fig. 3). Figure 4, showing the distribution of ages at which the habit was started, indicates that nine started the habit at birth, two at 1 month, five at 2 months, four at 3 months, three at 6 months, two at 9 months, three at 12 months, 1 at 18 months and 1 at 24 months. The majority of the group formed the habit during the nursing period or shortly afterwards.

The distribution of the ages at which the habit was broken is as follows: One at 9 months, three at 12 months, one at 1½ years, one at 2 years, three at 3 years, one at 3½ years, four at 4 years, four at 5 years, and three at 6 years (Fig. 5). That is, the habit was generally broken after the nursing period and most commonly in the fourth and fifth years.

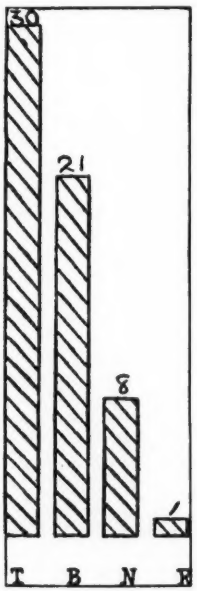

Fig. 7.—Number of Cases in which the habit was broken and number in which it persisted. *T*, total; *B*, habit broken; *N*, habit not broken; *R*, no report.

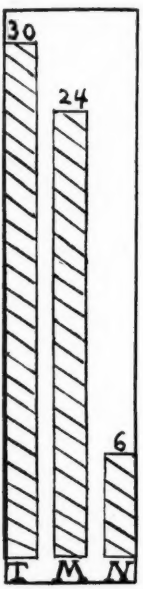

Fig. 8.—Comparative incidence of malocclusion and normal occlusion in the thirty thumb-sucking cases. *T*, total; *M*, malocclusion; *N*, normal occlusion.

Figure 6 shows the times at which the habit was indulged. Of the thirty children, thirty sucked their thumbs when going to bed, seven when asleep, ten on awakening, twenty when tired, twenty-four at nap-time, four during play, thirteen when idle and eleven when hungry. That is, the habit is in most cases associated with sleep; the majority of the children suck their thumbs at bed-time, nap-time and when they are tired.

A comparison of the number of cases in which the habit was broken and the number in which it was not broken is shown in Figure 7. The habit was broken in twenty-one of the thirty cases; in eight cases, it was not broken, and on one case, we have no report.

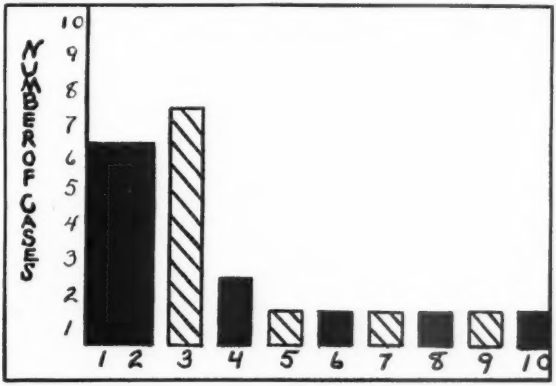

Fig. 9.—Comparative success of various methods of breaking the habit. *1*, appeal to pride; *2*, appeal to will power; *3*, tape on thumbs; *4*, sleeping garments covering hands; *5*, aluminum mits; *6*, elbow cuffs; *7*, toy to divert attention; *8*, rubber ring around thumb; *9*, bitter medicine; *10*, taking thumb from mouth during sleep.

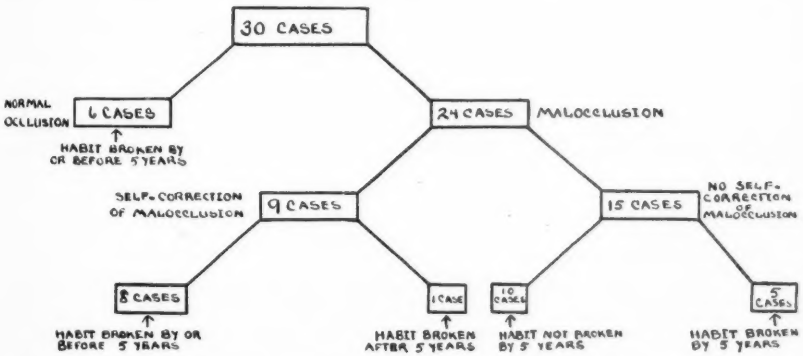

Fig. 10.—Occlusal phenomena associated with thumb-sucking in the thirty Merrill-Palmer cases.

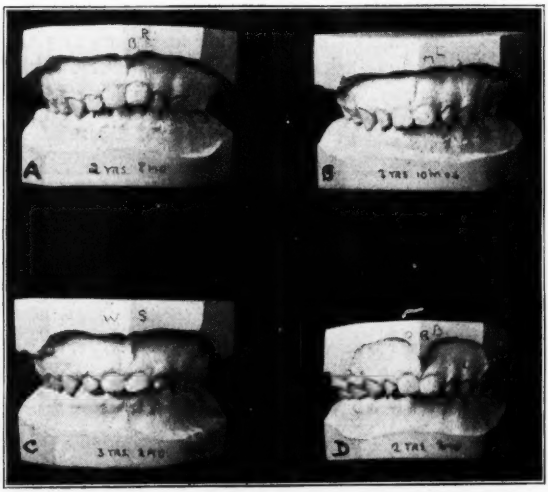

Fig. 11.—Models showing typical malocclusion resulting from thumb-sucking. *A*, right thumb sucked; *B*, left thumb sucked; *C* and *D*, both thumbs sucked.

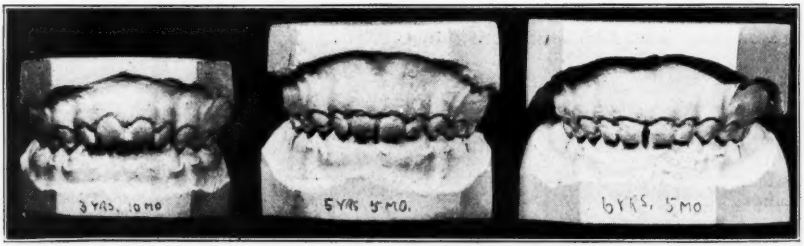

Fig. 12.—Models showing self-correction of malocclusion resulting from thumb-sucking. The habit was broken at 3½ years.

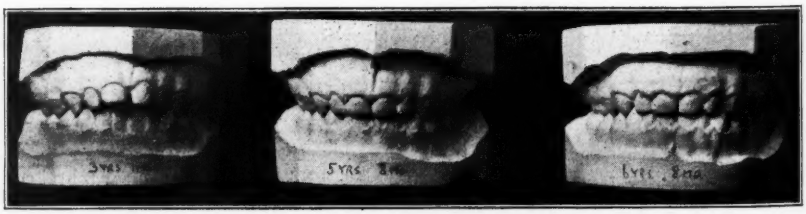

Fig. 13.—Classic example of self-correction in a case of malocclusion resulting from thumb-sucking. The habit was broken at 3 years.

Figure 8 shows the comparative incidence of malocclusion and normal occlusion in these thirty thumb-sucking cases. The malocclusion typical of the thumb-sucker is shown in twenty-four of the thirty cases. In six cases, the occlusion was normal. The evidence of this study, then, tends to disprove what some writers would have us believe—that thumb-sucking, as a rule, does not damage the deciduous teeth.

Figure 9 shows the comparative success of various methods of breaking the habit. The answers to the second questionnaire are the source of these data. The graph shows that psychologic methods were most successful with this group. Thus, in a total of twelve cases, an appeal to the child's "will power" or an appeal to his pride was successful. The eight mechanical methods used were successful in a total of fifteen cases. In seven cases, the habit was broken by putting tape on the thumbs; in two cases, by the use of sleeping garments covering the hands, and in one case, by using aluminum mits, elbow cuffs, a toy to divert attention, a rubber ring around the thumb or bitter medicine, or by taking the child's thumb from his mouth when he was asleep. This total of twenty-seven cases in which the habit was broken by various methods, as compared to the total of twenty-one shown in Figure 7, is accounted for by the fact that, in a few cases, one method was used successfully at one time and another method was used when the habit recurred.

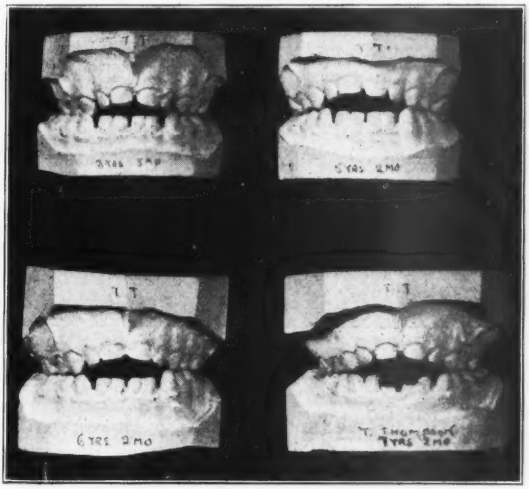

Fig. 14.—Models of a case in which malocclusion caused by thumb-sucking did not correct itself. The habit persists.

During the past year, we have tried out a method ascribed to Dunlap of Johns Hopkins University. The principle of this method is breaking the child of the habit by making him conscious of it. The child is taken from his play twice a day and made to suck his thumb for ten minutes before a mirror, until the

habit is broken. This method has proved successful in four cases in my private practice and is still being tried in several other cases for which no reports are available. It is probably advisable to select one's cases for this method, for, with certain children, a mechanical method or some other psychologic method proves more successful. In my experience, the use of elbow cuffs is most successful in the case of very young children or children who suck their thumbs only when they are going to sleep.

Figure 10 shows the various occlusal phenomena observed in the Merrill-Palmer group. Of the thirty cases, twenty-four showed the malocclusion typical of the thumb-sucker; in six cases, the occlusion was normal. Of the twenty-four cases of malocclusion, nine corrected themselves without the aid of appliances. In eight of these nine cases, the habit was broken before the child was 5 years of age; in one case, after the child was 5 years of age. In ten of the fifteen cases in which the malocclusion did not correct itself, the habit was not broken by the time the child was 5 years of age; in five cases, the habit was broken at that age. In all of the six cases showing normal occlusion, the habit was broken before the child was 5 years old—in fact, from one to three years before we made our first models.

It is interesting to note that not one case of malocclusion corrected itself as long as the habit was operative. In a majority of the cases in which the habit was broken at 3, 4 and 5 years of age, the malocclusion did correct itself. No definite conclusions can be made with reference to the former group until they have been observed for two or three more years.

Figures 11-17 are photographs of successive models of actual cases observed. Figure 11 illustrates the typical malocclusion resulting from thumb-sucking. The upper incisors and the premaxillary bone are displaced forward. In some cases, the lower incisors are retruded, but this condition is not a general one. As a rule, the displacement is toward the side of the thumb sucked. That is, when the right thumb is sucked, the displacement of the incisors is toward the right, and when the left thumb is sucked, the displacement is toward the left. When both thumbs are sucked, the displacement is symmetrically anterior.

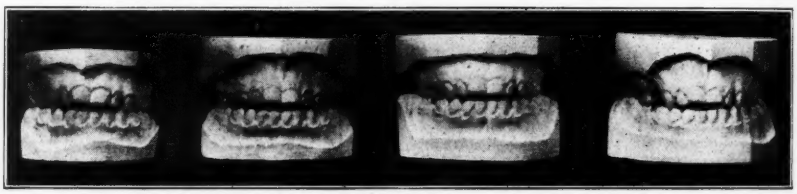

Fig. 15.—Models of a case in which malocclusion caused by thumb-sucking did not correct itself. The habit was broken at 7 years.

Our conclusion, then, is that thumb-sucking is the cause of a typical form of malocclusion in the deciduous series. We have found typical malformations associated with thumb-sucking in this group of thirty children. We have found that these malformations tend to correct themselves if the habit is broken by the

time the child is 5 years of age, but do not tend to correct themselves if the habit persists.

To apply our findings to practice, it would appear that the rational procedure in treating cases of malocclusion in the deciduous series caused by thumb-sucking is to break the habit as early as possible, and, in all instances, not later than the third or fourth years—and here the pediatrician could be made a valuable ally of the dentist, for he sees the children long before the dentist does—and at the same time, to keep a record of the case by making models once a year, in order that any changes in occlusion may be observed. Cases should be observed for a year or two before appliances are used.

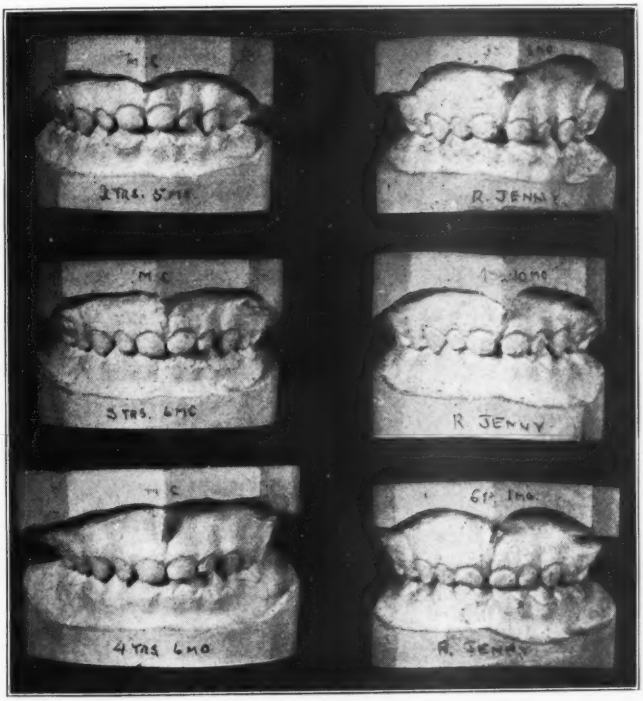

Fig. 16.—Models of two cases showing self-correction of malocclusion caused by thumb-sucking. In each case, the habit was broken by the time the child was 3 years old.

SUMMARY

1. There is a wide variance of opinion among authors of textbooks on orthodontia concerning the effect of thumb-sucking on the deciduous denture. In no case is scientific evidence given in support of the view held.

2. In general, the habit of thumb-sucking is started during the nursing period and broken after the nursing period.

3. Thumb-sucking is in most cases associated with sleep; the majority of the children suck their thumbs at bed-time, nap-time or when they are tired.

4. Thumb-sucking is a cause of malocclusion in the deciduous teeth. In a majority of cases (twenty-four out of thirty in the present study), it is associated with a typical malocclusion or deformity of the deciduous teeth, characterized by a forward displacement of the upper incisors and the premaxillary bone, and, at times, a retrusion of the lower incisors. As a rule, the displacement is toward the side of the thumb sucked; when both thumbs are sucked, the displacement is symmetrically.

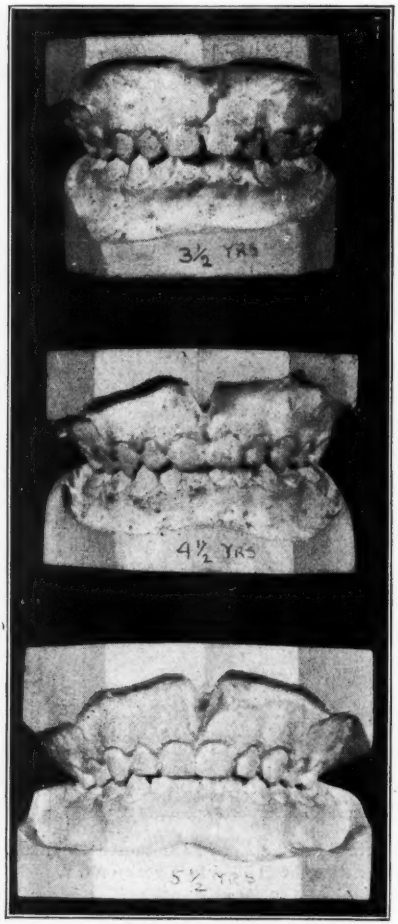

Fig. 17.—Models of a case showing self-correction of malocclusion caused by thumb-sucking. The habit was broken at 3½ years.

5. There is a general tendency for malformations resulting from thumb-sucking to correct themselves if the habit is broken by the time the child is 5 years of age; but the malformations do not, as a rule, correct themselves if the habit persists.

6. Psychologic methods of breaking the habit of thumb-sucking seem most successful in producing permanent results in the greater number of cases; in certain cases, mechanical methods are as successful.

7. The rational procedure in the treatment of these cases is to break the habit as early as possible, and to keep a record of the case by making models at regular intervals, perhaps once a year, in order that any changes in occlusion may be observed. Cases should be observed for a year or two before the use of appliances is considered.

613-619 David Whitney Building.

DISCUSSION

B. W. Weinberger, New York City: Of the percentage of cases of thumb-sucking that were broken, what was the percentage of those started at birth, or those acquired during the, you might say, teething period? Have you any record of that?

Dr. Lewis: That record has not been made yet, but will be made. This study has just started.

Dr. Weinberger: The reason I bring up that question is this: as this is probably a preliminary report, I would appreciate it very much in further studies if Dr. Lewis will observe that one point. Pediatricians say, and I myself am firmly convinced, that we have

two types of thumb-suckers to contend with, those that began at birth or immediately afterwards, and those that acquire the habit later. In the latter, we are able to break the habit more easily, but those that start at birth give us the greatest difficulty. They are hardest to break of the habit, or it is even believed impossible to break them of the habit.

O. T. Rule, Stamford, Conn.: I wonder if babies who are bottle fed are more prone to develop the thumb-sucking habit, because the bottle is frequently left with them. Breast-fed babies get their meals and are laid down without anything remaining in their mouths. I also wonder if the use of pacifiers results in greater deformities than does thumb-sucking.

Milo Hellman, New York City: Dr. Lewis is following out a procedure which has been considered as most necessary in the study of the development as far as growth and differentiation are concerned. As far as the work is concerned, Dr. Lewis is to be congratulated. From the general tenor of the paper, it might be assumed that he is a bit too lenient with himself and rather harsh with others. For instance, he makes a definite statement that finger-sucking is the cause of malocclusion. His evidence is not quite so strong as to warrant this statement. He has not seen these cases before the sucking process was started, and he is not so sure that they were normal then. Another definite statement made is that no scientific work has hitherto been done on the question of finger-sucking. If he will look up the records of the American Society of Orthodontists, he will find a paper which was read before the annual meeting in 1921. In that paper, he will find that this question was gone into scientifically at least to some degree.

Dr. Lewis (closing): I rather expected to have Dr. Hellman differ with me with reference to my findings, yet I am thoroughly convinced that the evidence presented offers proof that thumb-sucking does cause a definite type of malocclusion in the deciduous teeth. I further believe that were Dr. Hellman to examine my records and the models of the cases presented, he would agree with me. Of the 170 children under observation, not one showed this typical malocclusion where there was no thumb-sucking habit. In one case, the habit was broken at 3½ years; and at 5 years, the malocclusion had practically disappeared. At about 6 years, the habit recurred and the permanent central incisors began to protrude. I shall be able to show them at a later time. I am sorry that I did not find the paper Dr. Hellman mentioned. I tried to go over the literature very carefully. Now about controls. Every one engaged in research work realizes the value of controls, and I wish that it were possible in our work. We have a sort of control factor in the many children under observation who do not suck their thumbs. Whether or not Dr. Weinberger's observations are correct I cannot say, but I do know that some of our patients started to suck the thumb at birth, yet were broken of the habit completely. In the future, I shall be very glad to keep this particular point in mind when making observations. I have tried to present the evidence that we have gathered, uninfluenced by subjective thought, and, as I stated in my paper, rather in the form of a preliminary report. This work is going on, and as more evidence is gathered, it will be published. It will be interesting to see what happens to some of these cases after the permanent teeth have erupted.

FRACTURES OF THE MANDIBLE: AN ANALYSIS OF FIFTY CASES*

By H. TRENDLEY DEAN, D.D.S., Staten Island, N. Y.

THIS paper is based upon a study of fifty cases of fracture of the mandible. All of the cases in this series were treated personally and observed daily by me in the United States Marine Hospital, Stapleton, New York City. Good functional results ensued in all but one case. Special study will be made of: (1) the compounding tooth in the line of fracture; (2) unusual delay in receiving treatment after injury, and (3) the influence of associated syphilis. The second and third will be compared from the standpoint of causative factors of delayed union.

TYPE OF PATIENT

By occupation, all the patients were seamen except one, an electrician. All were males. Forty-one, or 82 per cent, were merchant seamen; seven, or 14 per cent, were from the U. S. Coast Guard, while the U. S. Army Transport Service and the U. S. Employee's Compensation Commission each accounted for one, or 2 per cent.

AGE GROUPS

As a greater proportion of young men engage in seafaring occupations, it is natural to find the youngest group suffering the highest percentage of injuries. Dividing this series into age groups, we find that twenty-one cases, or 42 per cent, occurred in patients between 20 and 30 years of age. Eighteen patients, or 36 per cent, gave their ages as between 30 and 40 years; while the remainder, eleven, or 22 per cent, were men between 40 and 50 years of age.

HOW INJURY WAS INCURRED

The manner in which the injuries were incurred is somewhat less broad in scope than would be found in a series of this number in a civilian hospital. Fighting accounted for nineteen, or 38 per cent, of injuries; holdups, fourteen, or 28 per cent; accidents, fourteen, or 28 per cent, while the remaining three patients were too drunk to know how they incurred the fracture.

The accidents deserve further analysis. Of the fourteen listed under this heading, the slipping of a wrench, capstan bar or iron block accounted for six; slipping and losing one's footing aboard ship explained three; while one man was injured by a blow on the jaw from a cargo lift, one, by a whisky bottle; one, a baseball; one, by falling down stairs; and one was knocked down by an electric current.

LOCATION OF FRACTURES

In this series, thirty-one, or 62 per cent, of the fractures were single; sixteen, or 32 per cent, were double, while three, or 6 per cent, were triple. The location of the thirty-one single fractures were as follows: angle, eighteen, or 58.1 per cent;

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

symphysis, five, or 16.1 per cent; mental foramen region, four, or 12.9 per cent; molar region, three, or 9.7 per cent, and neck of the condyle, one, or 3.2 per cent. The sites of the sixteen double fractures were: mental foramen one side and angle opposite side, nine; angle and symphysis, and condyle and symphysis, two each; and one each, at both angles, both first molar regions, and condyle and mental foramen opposite sides. Of the three triple fractures, one was bilateral of the condyles with coronoid process of the right side, while the other two were sigmoid notch downward and backward to below the condyle and angle of the same side, and symphysis.

In 1926, Ivy and Curtis[1] reported a series of 100 cases of fracture of the mandible. They found that the various fractures in their series were: single, 68 per cent; double, 31 per cent, and triple, 1 per cent. The same investigators found that the greatest number of single fractures occur at the angle, while the mental foramen on one side and the angle on the opposite side account for 77.4 per cent of the double fractures. Reiter,[2] in a more recent article, reporting on fifty cases, states that "the most frequent single seat of fracture is in the region of the mental foramen."

A summary of the location of the fractures of this series (Table 1) both with respect to the percentage of single and double fractures, and place of the greatest number of single and double fractures, does not appear to indicate any essential difference from the earlier findings of Ivy and Curtis.

1. Ivy, R. H., and Curtis, L.: Dent. Cosmos, 68:439 (May) 1926.

2. Reiter, Edward: Dent. Cosmos, 70:772 (Aug.) 1928.

TREATMENT

For the sake of brevity, all references to the anatomic details and the muscular attachments of the mandible will be omitted. The degree and direction of displacement may vary greatly, this depending on the action of the attached muscles and the planes of fracture. The diagrammatic outlines of Blair and Ivy[3] and Ruggles[4] illustrate the muscular actions

TABLE 1.—SUMMARY OF LOCATION OF FRACTURES

Single Fractures

		Per Cent
Angle	18	or 58.1
Symphysis	5	or 16.1
Mental foramen region	4	or 12.9
Molar region	3	or 9.7
Neck of the condyle	1	or 3.2
Total	31	

Double Fractures

Mental foramen one side and angle opposite side	9
Angle and symphysis	2
Condyle and symphysis	2
Both angles	1
Both first molar regions	1
Condyle and mental foramen opposite sides	1
Total	16

Triple Fractures

Sigmoid notch downward and backward to below the condyle and angle, same side, and symphysis	2
Bilateral of the condyles with coronoid process of the right side	1
Total	3

which cause the displacement ordinarily found.

3. Blair, V. P., and Ivy, R. H.: Essentials of Oral Surgery, St. Louis: The C. V. Mosby Co., 1923.

4. Ruggles, S. D.: Dent. Summary, 34:641 (Sept.) 1919.

A temporary support consisting of an Aiguier headgear[5] with a rubber dam sling was adjusted at the first sitting in every case. This sling aids materially in putting the fragment or fragments at rest and tends to reduce swelling within reasonable limits. The gradual traction of this rubber sling has shown a tendency to reduce the fracture partially in many cases. As soon as the acute condition subsides, the fracture is reduced, the fragments being fixed by whatever method of fixation is chosen. The headgear is dispensed with.

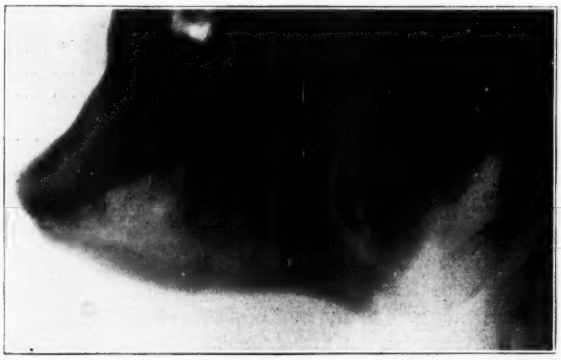

Fig. 1 (Case 1).—Appearance of fracture on admission of case to hospital.

TYPE OF FIXATION

The Eby[6] and Ivy[7] method of eyelet wiring was the method of choice in all cases in which it was possible to use it. This means of fixation was used in thirty-eight cases. The technic has been thoroughly described and illustrated in the professional journals and further comment would be superfluous. In seven cases, in addition to the eyelet-wiring type of intermaxillary fixation, a small interdental splint was used. This splint consisted in the main of from two to four bands made from orthodontic band material, soldered and joined by a 14-gage wire, and cemented into place.

These small interdental splints were used mainly as auxiliary supports for fractures in the region of the symphysis. After reduction and fixation by intermaxillary wiring, several patients complained of pain in the fracture region when swallowing. After the interdental splint had been cemented in place, the patient apparently suffered no further discomfort.

In three cases, the Winter's modified Baker anchorage as described by Darnell[8] was the method of fixation. The two remaining cases were treated solely by means of an interdental splint of the orthodontic band type.

5. Aiguier, J. E.: Dent. Cosmos, 60:602 (July) 1918.
6. Eby, J. D.: Internat. J. Orthodontia, 6:273 (May) 1920.
7. Ivy, R. H.: Surg. Gynec. Obst. 34:670 (May) 1922.
8. Darnall, W. L.: U. S. Nav. M. Bull., 19:42 (July) 1923.

PROCEDURE REGARDING TEETH IN LINE OF FRACTURE

In forty-four of the fifty cases, teeth were present in the line of fracture. In these forty-four cases, the teeth were removed immediately in thirty-three, or 75 per cent, of the cases. In two cases, or 4.5 per cent, the tooth in the line of fracture was undisturbed for ten days and then extracted, a method described by Blair and Ivy[3] as preventive of upward displacement of the posterior fragment.

Four cases presented special problems. In three, or 6.8 per cent, a molar tooth in the line of fracture was removed, but bicuspids or anterior teeth in the line of fracture were undisturbed. In the remaining, or 2.3 per cent, a bicuspid was extracted but a molar was not. Teeth in the line of fracture were not extracted in five cases, or 11.4 per cent, of the cases. In all of these cases in which the teeth were retained, the teeth were vital and at least the apical third of the root was not involved in the line of fracture. No infections developed in any of these selected cases in which the tooth was not extracted.

TABLE 2.—FIXATION METHODS

	Per Cent
Fixation by eyelet wiring	38
Fixation by eyelet wiring with additional small band splint	7
Total.....	45 or 90
Fixation by Winter's arches..	3 or 6
Fixation by interdental splints	2 or 4

As a general policy, teeth in the line of fracture are removed immediately except in certain types of carefully selected cases. All teeth showing far-advanced caries or periodontoclasia or which were pulpless were extracted without question, as were also those teeth, apparently sound otherwise, which were in a line of fracture where there was sufficient separation of the fragments to cause marked injury to the peridental membrane. Cases 1, 31 and 40 furnish an interesting study of teeth allowed to remain in the line of fracture. In these cases, injuries were incurred 136, eighty-seven and forty-two days, respectively, prior to admission. They had all been previously treated elsewhere, but the tooth in the line of fracture had not been removed. Osteomyelitis was present in each case, with a fistula draining extra-orally in Cases 1 and 31. On admission, the teeth in the line of fracture were removed at once. The area of osteomyelitis was curetted in Case 1, and expectant treatment resulted in uneventful recovery. (Figs. 1 and 2.)

TABLE 3.—PROCEDURE REGARDING TEETH IN LINE OF FRACTURE

		Per Cent
Teeth removed immediately	33	or 75.0
Teeth not removed	5	or 11.4
Teeth undisturbed during first ten days, then extracted.....	2	or 4.5
Molar extracted, bicuspid or anterior undisturbed	3	or 6.8
Bicuspid extracted, molar undisturbed	1	or 2.3
Total.....	44	100

IMPACTED TEETH IN LINE OF FRACTURE

Four cases revealed a complete impaction in the line of fracture. In Case 24, the impacted tooth was removed; in Cases 16, 17 and 32, the impaction was not disturbed. No infection developed and the fixation wires were removed in thirty-three, thirty-six, twenty-nine and thirty-four days, respectively, with good union in each case. (Fig. 3.)

NUMBER OF DAYS OF FIXATION

A firm union was deemed a matter of paramount importance in view of the patient's occupation. These men return to their work immediately after dis-

charge from the hospital, many of them "shipping out" on long foreign voyages during which time no medical attention is available. For this reason, the period of fixation, which averaged 43.2 days, may seem somewhat long on first inspection. The number of days of fixation and the number of cases is given in Table 4.

TABLE 4.—PERIOD OF FIXATION

Days of Fixation	No. of Cases
22	2
23	1
24	1
27	2
28	2
29	1
30	4
32	1
33	3
34	6
35	1
36	5
37	2
38	4
40	1
41	1
42	4
46	1
47	1
50	1
51	1
74	1
75	1
81	1
177	1
187	1
	50

DAYS' DELAY FROM INJURY TO HOSPITALIZATION

A study of the number of days elapsing from time of injury to admission to the hospital discloses some wide variations. Consequently, the following tabulation is interesting from the standpoint of what constitutes an ordinary delay in reporting for treatment. Cases 1, 31, 36, 39 and 40, which had received treatment in other hospitals, will be listed separately.

ORDINARY DELAY IN FIXATION FOLLOWING HOSPITALIZATION

What constitutes an ordinary delay in fixation after admission to the hospital, or, in other words, what is the average number of days elapsing from the time of admission until the jaws are wired? In referring to Table I of Reiter's[2] report covering the treatment of fifty cases of fracture of the mandible treated in the Cook County Hospital, Chicago, it is noted that the jaws were wired in forty-five cases. The total number of days elapsing from the date that the patient was admitted to the date that the jaws were wired were 226, or an approximate

TABLE 5.—PERIOD OF DELAY FROM INJURY TO HOSPITALIZATION

Previous treatment

Days' Delay	Total Days'Delay	No. of Cases
0	(0)	4
1	(8)	8
2	(12)	6
3	(18)	6
4	(12)	3
5	(10)	2
7	(21)	3
9	(18)	2
10	(10)	1
13	(26)	2
16	(16)	1
19	(19)	1
21	(21)	1
23	(23)	1
30	(30)	1
33	(33)	1
58	(58)	1
60	(60)	1
	395	45

Average of 8 7/9 days

Previous treatment

(Cases 1, 31, 36, 39 and 40)

38	1
42	1
62	1
87	1
136	1

Average of 73 days

average of five days. Omitting the five cases previously referred to as having first been treated elsewhere, I find that the forty-five remaining cases of this series show a total of 224 days elapsing from admission to fixation, or approximately the same average of five days.

TABLE 6.—DELAY IN FIXATION AFTER HOSPITALIZATION

Cook County Hospital			U. S. Marine Hospital		
No. Days Elapsing	Total Days Elapsing	No. Cases	No. Days Elapsing	Total Days Elapsing	No. Cases
0	(0)	6	1	(3)	3
1	(7)	7	2	(8)	4
2	(24)	12	3	(21)	7
3	(9)	3	4	(44)	11
4	(16)	4	5	(35)	7
5	(15)	3	6	(30)	5
6	(12)	2	7	(7)	1
7	(7)	1	8	(8)	1
8	(8)	1	9	(9)	1
9	(9)	1	10	(20)	2
16	(16)	1	11	(11)	1
18	(36)	2	12	(12)	1
33	(33)	1	16	(16)	1
34	(34)	1			
	226	45		224	45

TABLE 7.—CASES OF UNUSUAL DELAY BETWEEN INJURY AND HOSPITALIZATION

Cases	Days delay	Complications on Admission	Tooth in Line of Fracture Removed Immediately	Days of Fixation	Type
30	13	None	No	28	S*
25	13	None	Yes	34	S
50	16	None	Yes	28	S
43	19	Osteomyelitis	Yes	47	S
19	21	Cellulitis	Yes	34	S
6	23	Osteomyelitis	Yes	22	S
8	30	None	Yes	38	S
9	33	None	Yes	36	D
7	58	Osteomyelitis	Yes	50	T
29	60	None	†	33	S

*S, single; D, double; T, triple.

†Tooth in line of fracture removed a few days before the case was admitted.

The average period of fixation was thirty-five days and the results were all good. Two of these cases required more than forty-five days of fixation and can be classed as cases of delayed union. These two cases showed fractures with displacement; in each, a tooth was in the line of fracture and osteomyelitis was present at the time of admission to the hospital. With only two of the ten cases

UNUSUAL DELAY FROM INJURY TO ADMISSION

We have grouped together for special study those ten cases in which more than twelve days elapse before any treatment was received. (Table 7.)

showing an unusual delay in union, it would appear that delay in treatment is not so important a factor in delayed union as might be expected.

On discharge, all of the patients referred to in Table 8 had firm union, with the exception of the patient in Case 34, in whom there was no union and osteomyelitis is still present. This patient's jaws had been wired for thirty-five days when he developed pneumonia. All wiring was removed and no treatment rendered for twenty-four days. The jaws

TABLE 8.—POSSIBLE CAUSE OF DELAYED UNION

Case	Age	Days of Fixation	Days Delay Injury to Admission	Previous Treatment	Remarks
40	41	46	42	Yes	Tooth in line of fracture; osteomyelitis on admission
43	33	47	19	None	Marked swelling and osteomyelitis on admission
7	38	50	58	None	Osteomyelitis on admission
44	28	51	2	None	Syphilitic history; negative Wassermann reaction; antisyphilitic therapy immediately.
28	34	74	3	None	Tertiary syphilis; four plus Wassermann reaction.
34	32	75	2	None	Syphilitic history; negative Wassermann reaction; pneumonia during period of fixation. No union on discharge.
38	31	81	9	None	Tooth in line of fracture on admission; infection resolved into osteomyelitis.
39	47	177	38	Yes	Osteomyelitis on admission with fistula discharging on cheek.
14	46	187	3	None	Tertiary syphilis; four plus Wassermann reaction.

TABLE 9.—ANALYSIS OF CASES SHOWING WEAK OR STRONG WASSERMANN REACTIONS

Case	Wassermann Reaction	Days delay in treatment	Days of fixation	Remarks
3	Plus-minus	1	32	
18	Plus-minus	9	42	
8	One plus	30	38	
12	One plus	7	37	
21	1 neg; 1 three plus	1	42	
5	Four plus	1	35	Mixed antisyphilitic therapy begun immediately.
14	Four plus	3	187	Mixed antisyphilitic therapy begun 133 days after admission.
28	Four plus	3	74	Mixed antisyphilitic therapy begun 25 days after admission.

POSSIBLE CAUSE OF DELAYED UNION

In this series, nine cases required more than forty-five days of fixation and therefore may be classified as cases of delayed union. (Table 8.)

were then again wired and fixation continued for a period of forty days, with the unsuccessful results noted.

In Case 28, there was good union clinically although the roentgenogram showed marked loss of bone in the fracture site. As a safety measure, a small saddle splint was cemented into place. The patient returned about six months later, stating that he had suffered no discomfort. Roentgenograms showed excellent osseous regeneration. (Figs. 4-6.)

Analysis of these nine cases discloses two main causes of delayed union: osteomyelitis (apparently of a low-grade streptococcic type) and syphilis. Osteomyelitis was the apparent cause of delayed union in five cases. Four of these cases showed osteomyelitis on admission, two of the four having been treated elsewhere. The other two have been previously referred to in the study of the group showing unusual delay in receiving treatment. The fifth case was one in which only nine days had elapsed since injury. In this case, a suppurating infection was present at the time of admission, although there was no roentgenographic evidence of osteomyelitis.

The four remaining cases are rather interesting. First, there is little delay from the time of injury to treatment, i. e., two cases showed a two days'delay, the other two, only a three days' delay. There is behind each of the four a history of syphilis. Two of the four were diagnosed clinically as tertiary syphilis and gave a four plus Wassermann reaction.

Fig. 2 (Case 1).—Treatment completed.

POSSIBLE INFLUENCE OF SYPHILIS ON TREATMENT

A blood Wassermann test was made in forty-four of the fifty cases being reported. Of the forty-four, thirty-six, or approximately 82 per cent, were negative; four, or about 9 per cent, showed a weak reaction, a plus-minus or a one plus; three, or 7 per cent, gave a four plus reaction; while one was undetermined, giving both a negative and a three plus reaction in two tests. Further analyzing the cases that showed either a

strong or weak reaction, we find the results given in Table 9.

GENERAL OBSERVATIONS

A study of this series indicates that delay in applying for treatment is not so important a causative factor in delayed union as associated syphilis or osteomyelitis, although the latter is not infrequently the effect of delayed treatment. Four of the nine cases of delayed union, or 45 per cent, were those in which there had been no appreciable delay in reporting for treatment. It is very interesting to note that all four of these cases disclosed a syphilitic background. With this fact in mind, the possibilities of syphilis as a causative factor in delayed union cannot be minimized. As a consequence, in each case of fracture of the mandible, we make a searching inquiry for a history, clinical findings, or serologic reaction indicative of syphilis, in order to institute antisyphilitic therapy as soon as possible.

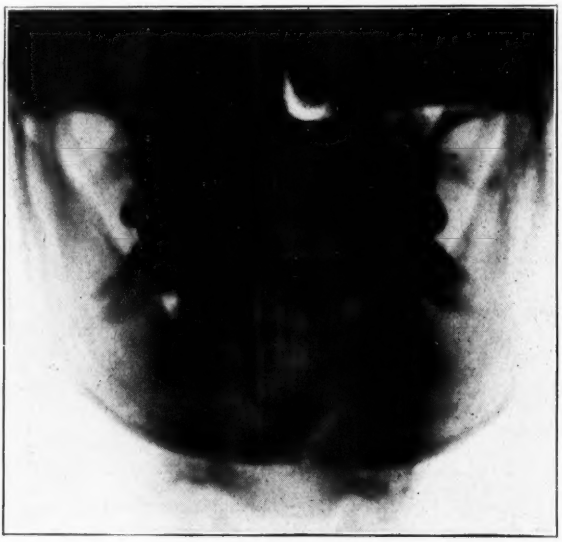

Fig. 3.—Impacted tooth in line of fracture.

SUMMARY

1. The most common site in single fractures is at the angle. Of double fractures, those occurring at the mental foramen on one side and the angle on the opposite side account for more than all other types of double fractures combined.

2. Except in certain carefully selected cases, the compounding teeth in line of fracture should be extracted immediately.

3. Unusual delay in receiving treatment does not ordinarily predispose to unusual delay in union.

4. Antisyphilitic therapy is indicated as adjunct medical treatment in all fracture cases in which there is a previous history of syphilitic infection.

U. S. Marine Hospital, Stapleton (S. I.), New York City.

DISCUSSION

E. C. Hume, Louisville, Ky.: My service in connection with fractures and injuries of the facial bones has been very different from that of Dr. Dean's. Most of my cases have been those complicated by other injuries—industrial accidents, automobile accidents, gunshot wounds and injuries of that nature. The history of the injury itself often reveals quite a good deal about the actual outcome of the case, whether or not the patient was injured on the street, and the possibility of a tetanus developing. I agree with Dr. Dean relative to employment of the Wassermann test in practically all cases. It should be given as soon as the patient is admitted to hospital. I think that we should have some blood chemistry tests made also in most of these fracture cases because we find that a few of the patients are diabetic, and diabetic cases do not heal very rapidly until they are sugar free. The method of fixation is the one that you and I and everyone else can use best. Some men like splints entirely. I agree with Dr. Dean that the eyelet method of wiring is best for most of these cases when we have a sufficient number of teeth included to apply the method properly. If it is desired to combine this with some type of splint, that is permissible. It is good functional results that we are looking for, with the minimum amount of scar and traumatization of the tissues on the outside of the face. Should an abscess develop, we should drain it promptly at the most dependent point, even if it is on the outside of the face, to avoid osteomyelitis. As far as delay in admittance of patients to the hospitals is concerned, this is a condition with which we all have to contend. It has been my practice to remove devitalized teeth in the line of fracture if the root end is in the line of fracture. If the teeth are vital, we should not disturb them any more than is necessary. In other words, the quicker we can get the fractured end of the bone in position and fixed with safety to our patient, with the least possible injury to the fractured end of the bone, the better off we are. When we have skull fractures and chest injuries, that is a rather difficult procedure to follow because the patient may die from an intracranial hemorrhage or meningitis and we may be accused of criminal neglect. If injuries to the tongue and throat are present, it is inadvisable to establish fixation and close the mouth immediately.

Fig. 4 (Case 28).—Appearance of fracture on admission of case to hospital.

W. L. Coggin, Charlestown, S. C.: I would like to ask Dr. Dean whether, in case he has a fracture in the third molar region he removes this molar. What should be used for a support on this piece of bone that is posterior from the fracture? Do you just wire or do you put a bandage or a splint or anything on to hold the bone intact? I have had very good results from wiring the jaw without putting in any splint at all. At what time do you usually wire the jaw—how many days or hours after a fracture case comes in? I would rather wait about two days until the inflammation subsides than to be too hasty in wiring my cases.

John L. Schock, Washington, D. C.: Dr. Dean's findings regarding the relation between a positive Wassermann test and delay in union of fractures have been borne out in my own experience. It seems to me that the period of fixation reported is rather prolonged. If some union has not occurred in one month, a change in the method of treatment is advisable.

Dr. Dean (closing): I agree with Dr. Hume respecting associated constitutional disorders, such as diabetes. Many times, a consultation with the patient's physician respecting the past history or present condition will disclose latent disease, the proper treatment of which will eliminate long delay in obtaining union, or in rare cases, possibly, obviate nonunion. A complete medical history of the patient at the beginning of treatment is of paramount importance. The question of a fracture just posterior from and involving the third molar is one of our old problems. It must be remembered in this type of fracture, as in all others in the mandible, that there are two planes: one, anteropos-

Fig. 5 (Case 28).—Appearance of jaw during treatment. Tertiary syphilis was an associated condition.

terior, and another, buccolingual. In addition, the obliquity of the fracture and the effect of the traction of the powerful muscles at that point must be carefully considered. In several cases, I have followed the suggestion of Blair and Ivy in their "Essentials of Oral Surgery." If there is a third molar in the line of fracture, retain it for a period of from seven to ten days even at the risk of infection in order to hold the posterior fragment in proper position until a temporary callus is formed. This third molar tends to act as a splint for the posterior, or proximal, fragment. We must keep the area under close observation and at the first signs of infection or disturbance immediately remove the tooth. If this is done carefully, the proximal fragment generally remains in its proper position. The number of days of fixation is somewhat higher than that in Dr. Schock's cases for the reason that these seamen seldom return for observation or outpatient treatment once the wiring is removed and they are discharged from the hospital. Whereas Dr. Schock may keep his patient under observation, for as long as he wishes after the fixation has been removed, and may prescribe whatever diet he thinks best, my patients are probably headed for South America or Europe a few days after the wiring is off. This additional time, then, is purely a safety margin because, when the patient gets in the fo'castle of a merchant vessel, he receives only the regular ship ration.

Fig. 6 (Case 28).—Appearance of case shown in Figures 4-5, six months after the roentgenogram in Figure 5 was taken.

"WHY ROOT CANALS SHOULD BE FILLED TO THE DENTINOCEMENTAL JUNCTION"*

By BALINT ORBAN, M.D., Vienna, Austria

DURING my stay in America, I frequently had the opportunity to discuss in connection with root-canal problems the question of the "dentinocemental junction." I have discussed this with many successful operators, men who were vitally interested in this problem. From them, I have obtained the practical operator's point of view concerning the possibility of removing pulps and filling root canals to the dentinocemental junction. The almost unanimous opinion was that this could seldom be accomplished through intent.

Our only means of obtaining definite information as to what really is accomplished in this procedure, therefore, is the histologic microscopic study of extracted treated teeth. The examination of roentgen-ray pictures of actually treated teeth affords strong evidence as to what can and will be found with the microscope. A large majority of the canals are either overfilled or underfilled; only a small percentage appear actually to be filled to the "critical point." Microscopically, we find that even in the seemingly properly filled canals, the filling rarely extends to the "critical point."

During the time that I was director of the research laboratory at the Chicago College of Dental Surgery, Dr. Coolidge, on my suggestion, thoroughly investigated this question on the basis of the very extensive human material at our disposal there. He showed how utterly impossible it was to use the dentinocemental junction as a landmark in root-canal work. These findings were published in THE JOURNAL.[1] I refer the reader to this article for complete information on the subject. In the February issue of THE JOURNAL, Carl J. Grove discussed this subject. In it, he made many statements that should not be passed by without critical analysis.

We read the following in his article:

> That a definite junction of the dentin and the cementum exists is not questioned by those who have studied sections of root end tissue prepared for this purpose only. Sections selected at random may be misleading because of distortion due to concavity or convexity of the surface of the root as well as existing curvatures. One should not be misled by the presentation of such specimens. It is possible to prepare microscopic sections of any tissue so that cells of the structure are not even recognizable.

It is to be regretted that Dr. Grove did not specifically mention the paper which he had in mind in formulating his criticism. It appears hardly fair to the reader to leave him in doubt as to whom this criticism concerns. Since Dr. Grove omitted this important detail, we will assume that it was prompted by the Coolidge article. If it is possible for Dr.

*A criticism of an article published under this title by Grove, C. J.: J.A.D.A., 16:293 (Feb.) 1930.

1. Coolidge, E. D.: Anatomy of the Root Apex in Relation to Treatment Problems, J. A. D. A., 16:1456 (Aug.) 1929.

Grove to cite any authorities, I should like to have him give the names of those who do not question the existence of a definite junction of the dentin and cementum at the apex, because I should like to see the pictures from the specimens upon which these statements are based. Statements not based on actual specimens are worthless. Opinions prove nothing in this work.

I would further ask for a more detailed explanation concerning the statement that specimens must be prepared for this purpose only. I wonder if Dr. Grove selects his cases for clinical root-canal work upon the basis of a "definite dentinocemental junction." If he selects his clinical cases, may we ask just what these "clinical diagnostic symptoms" are? The paper of Coolidge was based upon specimens that were serially sectioned and not distorted. Furthermore, all the teeth were sectioned with their investing hard and soft tissues. In this way, every possibility for distortion was eliminated. From material carefully prepared in this manner, Coolidge showed about twelve sections from different teeth, basing his conclusions upon these sections. In scientific writings, it is customary to offer evidence as weighty or more weighty than that of other investigators when refuting their findings.

Let us see to what extent Grove's article follows this common usage. Both of the sections which he shows are from extracted teeth. The pulp is completely torn from the walls of the dentin; undoubtedly the result of the mode of preparation. From a specimen of this type, reliable information as to root canals cannot be obtained. In addition, the teeth were taken from a very young individual; the size of the pulp canals and the diverging funnel-like character of the apical openings are typical of a developing tooth. Every operator knows that this type of tooth presents an entirely different problem, and therefore can by no means be used as an illustration of general root-canal work. Grove apparently criticizes a paper on the subject in question which is based on a study of at least twelve different teeth; and yet he selects one exceptional case, and upon the basis of this case, attempts to establish a scientific foundation for his clinical practice.

I absolutely agree with Grove when he says, "It is possible to prepare microscopic sections of any tissue so that the cells of the structure are not even recognizable." I would even go so far as to say that unfortunately too great a majority of people do their investigating on material so prepared. Grove's case certainly was prepared in such a manner that no one is able to recognize any cell structure.

The other statements of Grove's concerning the character and structure of the pulp at the apex are plausible, but even these are based on opinion only and not at all on histologic facts. And this is the chief point upon which I wish to base my final conclusion: In scientific questions, opinions and views of any kind should not be transmitted from one man to another, from one textbook to another, or from one generation to another, unless they are based upon actual findings. Anyone who indulges in such a practice automatically subjects himself to the criticism of those who are well equipped to supply facts that can withstand the acid test of thorough investigation.

Opinions cannot be substituted for scientific evidence, and Grove's material is absolutely inadequate to supply the proof which he would like to deduce from it.

NORMAL CHARACTERISTICS OF THE GINGIVA AND THEIR RELATION TO PATHOLOGY*

By WILLIAM G. SKILLEN, D.D.S., Chicago, Ill.

IN a previous article,[1] conditions as they exist normally in the gingivae on the buccal and lingual surfaces of the rat molars were described. The present contribution embraces a study of the interproximal gingivae of the same animal, and the labial, buccal and lingual gingivae of the dog. In addition, it touches on some phases of pathologic processes as they occur in both animals.

The former study particularly lent support to the contentions of Becks[2] in showing that the changes which he describes as taking place normally in the gingivae could be clearly and definitely observed on the buccal and lingual surfaces of the rat molar. These changes are, namely, the degeneration of the *entire* epithelial attachment (enamel epithelium); the proliferation of the mouth epithelium downward, behind the former, as it were, to replace it, and a shifting of the epithelial attachment and gingiva toward the apex as the above mentioned changes approach the enamel-cemental junction, the latter change corresponding to the findings of Gottlieb.[3] It was further shown that, in the same areas in the same animal, a prominent and well-developed keratinized layer forms on the surface of the proliferating mouth epithelium.

These changes are here illustrated again (Fig. 1), for the sake of comparison with what follows. At *A* is the secondary cuticle which represents the atrophied remains of the epithelial attachment (*C*), with which it is continuous. It has been left behind, adhering to the enamel by the shifting of the gingiva toward the apex. The still vital part of the epithelial attachment (*C*) has begun to grow (*T*-*T*[1]) down the surface of the root. The proliferating mouth epithelium (*B*) terminates at *B*[1], above which point, for a short distance, it is separated from the epithelial attachment (*C*) by a papilla of connective tissue. The keratinized layer of the proliferated mouth epithelium (*K*) terminates at *K*[1]. There is no pocket or crevice, the slight tearing of the tissues at the crest of the gingiva having been produced during preparation.

Further study tends to show that these changes which are so readily observed and so characteristic of the buccal and lingual gingivae of the rat molar are not, at least in their entirety, characteristic of the interproximal gingivae of that animal. That there might be such a difference in the structure of the gingivae has never heretofore even been hinted at; yet such seems to be the case.

*From the department of Histology, Northwestern University Dental School.

1. Skillen, W. G.: Morphology of the Gingivae of the Rat Molar, J. A. D. A., 17:645 (April) 1930.

2. Becks, Hermann: Normal and Pathologic Pocket Formation, J. A. D. A., 16:2167 (Dec.) 1929.

3. Gottlieb, Bernhard: Deutsch. Monatschr. f. Zahnhlk., 1921, p. 142.

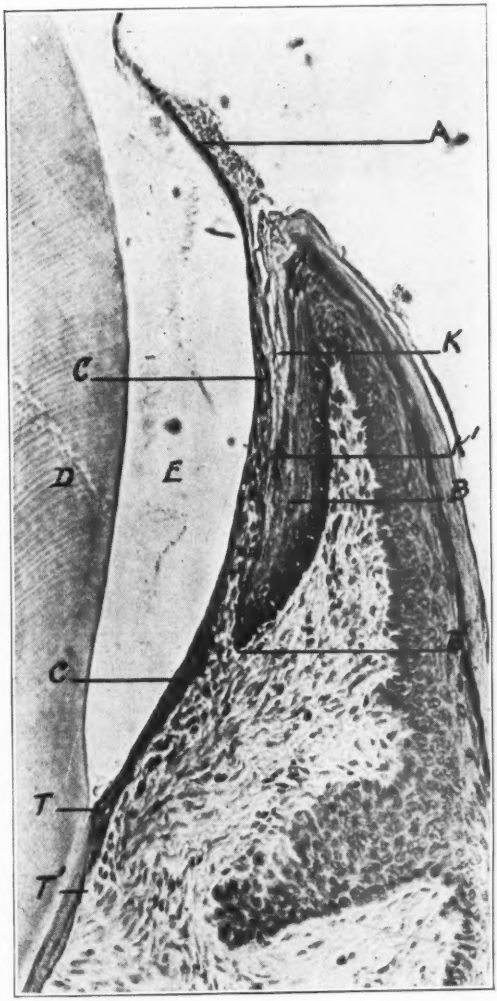

Fig. 1.—Normal conditions as they may exist in the buccal and lingual gingivae of the rat molar. *A*, the secondary cuticle, continuous with *C*, the atrophying epithelial attachment. From *T*, the enamel-cemental junction, the epithelial attachment has grown along the root to T^1. *B*, proliferating mouth epithelium terminating at B^1, *K*, keratinized layer of the proliferating mouth epithelium terminating at K^1. *D*, dentin. *E*, enamel space. There is no pocket.

The most prominent of the changes enumerated above, namely, the proliferation of the mouth epithelium, does not, apparently, take place in the interproximal region. If, for instance, serial sections through the interproximal area are stud-

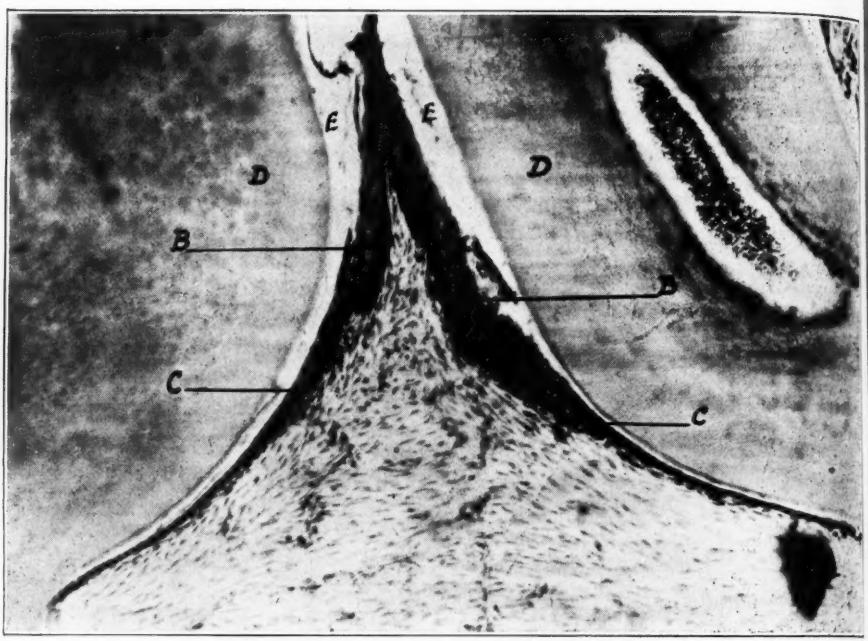

Fig. 2.—A cut toward the buccal surface of the interproximal gingiva of rat molars. *B*, proliferating mouth epithelium. *C*, epithelial attachment. *D*, dentin. *E*, enamel space.

ied, it will be observed that the mouth epithelium, which is conspicuous in the first or more superficial cuts, disappears from view as the midline of the area is approached.

Figures 2 and 3 serve to illustrate this feature. The former is a superficial cut through the buccal aspect of the interproximal area. At *B* is the mouth epithelium growing downward behind the degenerating epithelial attachment (*C*). It is a simple matter to distinguish between the two epitheliums. Figure 3 shows an area a little deeper within the interproximal area. Here, only one epithelial layer, apparently the epithelial attachment (*C*), is to be observed. Neither the characteristic arrangement observable on other surfaces of the tooth nor that observable in the superficial cut can be seen.

Furthermore, it may be shown that, as the teeth approach the eruption stage, the still intact, unaltered enamel epitheliums on the interproximal surfaces of the two adjacent teeth meet and fuse. Their basal layers come to lie in such close contact that the line of union cannot be distinguished. Apparently, all of the connective tissue which at one time intervened has been pushed aside. Clearly, there is no room for mouth epithelium to grow in this area.

This feature is illustrated in Figure 4. The two teeth are approaching eruption, one slightly in advance of the other. At *T* is the enamel-cemental junction. From this point, the enamel epithelium (*C*) of

each tooth may be followed to the point (C^1) where they unite. This united enamel epithelium (U) may then be followed up between the teeth to where it separates again and becomes continuous with the mucous membrane (B), still covering most of the occlusal surfaces of the teeth. The nature of this epithelium is easily determined by the tall, columnar ameloblasts (M) on its surfaces facing the respective enamel spaces (E). The basal layers of the respective enamel epitheliums lie in contact.

During subsequent stages of eruption, this united enamel epithelium becomes more and more compressed where it passes between the contact surfaces of the teeth, finally forming an extremely thin, elongated sheet of epithelium arranged in a buccolingual and occluso-apical direction. It finally becomes separated from the mucous membrane, which persists for a time over the occlusal surface.

It would seem, then, that outside the most superficial aspect at the entrance to the interproximal embrasure, enamel epithelium alone covers the gingiva in that area. If, now, this epithelium is to be replaced by mouth epithelium, as occurs regularly on the other surfaces of the tooth, it can take place only by a sideways growth of the mouth epithelium from its more superficial location on the buccal and lingual aspect. As this does not seem to be the normal direction, which apparently is in an apical direction, it is doubtful that it occurs at all. So far, at least, it has been impossible to distinguish any such growth.

The other changes which have been enumerated do occur in the interproximal area, but with less regularity and not without complication.

Degeneration of the epithelial attachment (enamel epithelium) similar to that occurring on the other surfaces sets in, but is soon complicated and masked by pathologic changes, which will be discussed later. Degeneration of tissue in this area is more easily explained than it is on the other surfaces. Through the compression attendant on eruption of the teeth, the epithelium is cut off from the circulation and is then subject to atrophy. Such a change is shown in Figure 3 at C^1.

In the dog, the same changes occur on the labial, buccal and lingual surfaces as have been described for corresponding areas in the rat, but they are not, on the whole, so distinct or so readily observed.

Atrophy of the epithelial attachment seems to occur, but apparently the tissue does not remain so nearly intact as it does in the rat. It does not form a secondary cuticle. As atrophy proceeds, desquamation of the dead cells at the crest of the gingiva seems to take place as a fairly regular occurrence. A pocket is thus formed which is bounded on the tooth side by the primary cuticle and on the other side by the proliferating mouth epithelium. Becks describes a similar process.

It is more difficult, frequently quite impossible, to distinguish between epithelial attachment and proliferating mouth epithelium. The reason for this seems to lie in the fact that the proliferating mouth epithelium in the dog does not become keratinized. Therefore, there is not the definite line of demarcation between the two epitheliums which is so characteristic of the rat.

Examples of these changes in the dog are illustrated in Figures 5 and 6. The former is from a comparatively young animal, and the gingiva is quite high. At B^1, the proliferating mouth epithelium is well united with the epithelial attachment (C). There is a slight difference in the staining reaction of the two. At B is the mouth epithelium on the oral surface of

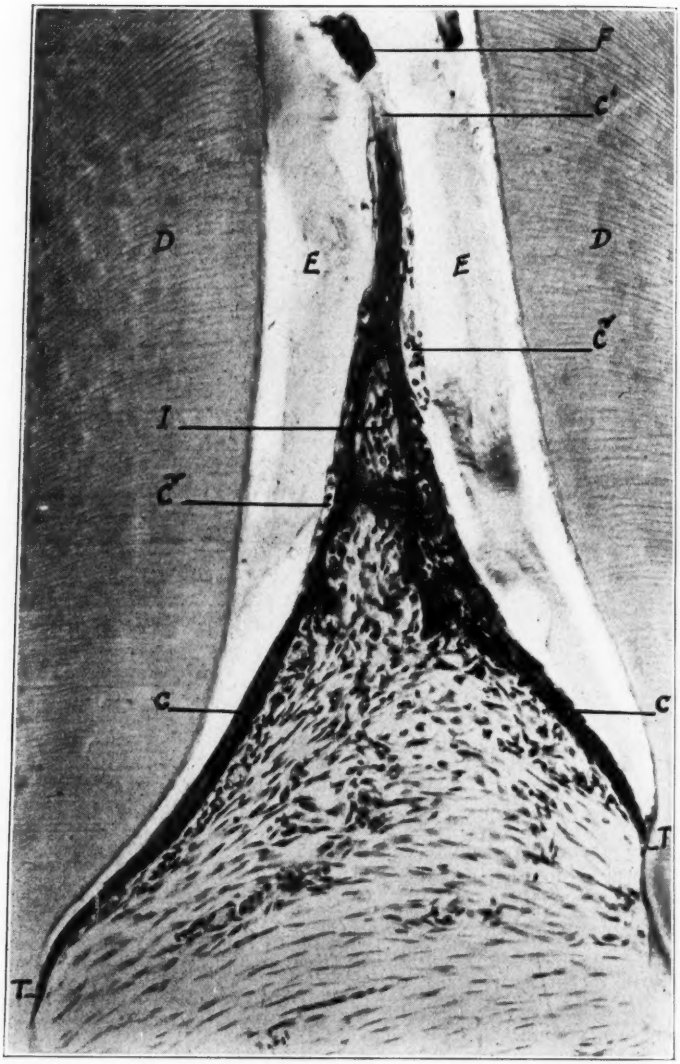

Fig. 3.—Central cut through the interproximal gingiva of rat molars. *F*, calculus. C^1, atrophy of epithelial attachment. C^2, necrosis of epithelial attachment. *C*, intact epithelial attachment. *T*, enamel-cemental junction. *D*, dentin. *E*, enamel space with enamel remnants. *I*, infiltration of subepithelial tissue adjacent to which there is proliferation of the epithelial attachment. No mouth epithelium is to be seen growing behind the epithelial attachment.

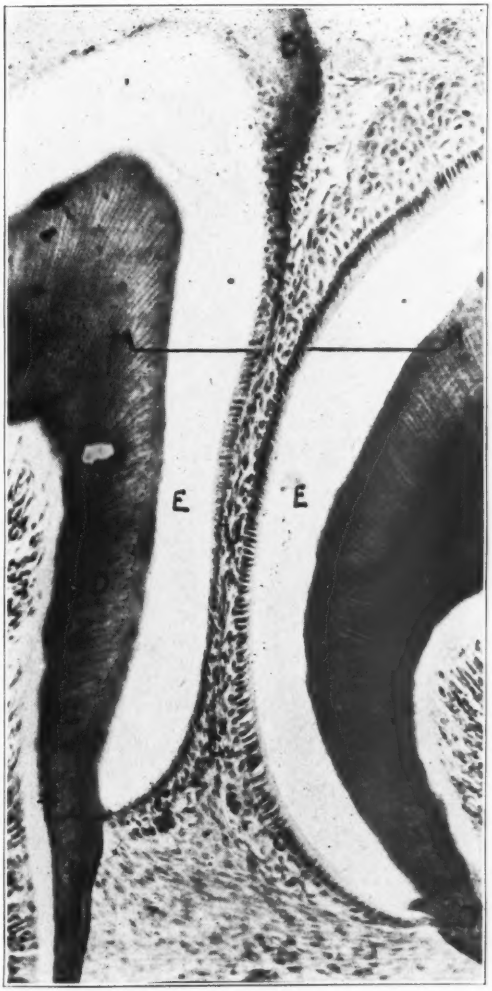

Fig. 4.—Central cut through the interproximal gingiva of the erupting molar teeth of the rat. *B*, mucous membrane partly covering the occlusal surfaces of the teeth. *M*, ameloblasts on the surface of the enamel epithelium. *U*, united enamel epithelium. *E*, enamel space. *D*, dentin. C^1, point at which enamel epitheliums unite. *T*, enamel-cemental junction.

the gingiva. It may be noticed that even here this epithelium does not exhibit a very highly developed keratinized layer; cell nuclei are discernible right to the surface. There apparently existed a very shallow pocket (*O*) in this instance, due to desquamation of the epithelial attachment at the crest of the gingiva. Separa-

tion of the surface cells (*P*) is probably an artefact.

Figure 6 is from an older animal. The epithelial attachment in this instance has just begun to grow down the root. The pocket (*S*) is still some distance from the enamel-cemental junction. The pocket, apparently, has been formed through desquamation of the epithelial attachment (*C*), in which signs of degeneration are discernible. A few atrophied remnants still adhere to the primary cuticle (*P*) in the region of the pocket. The mouth epithelium (*B*) has grown farther toward the enamel-cemental junction in this instance than in the former, and, at its tip, is separated from the epithelial attachment for a short distance by a papilla of connective tissue. It exhibits no keratinized layer. A slight inflammatory reaction (*I*) is noticeable in the connective tissue near the bottom of the pocket and to a less extent throughout the rest of the subepithelial area.

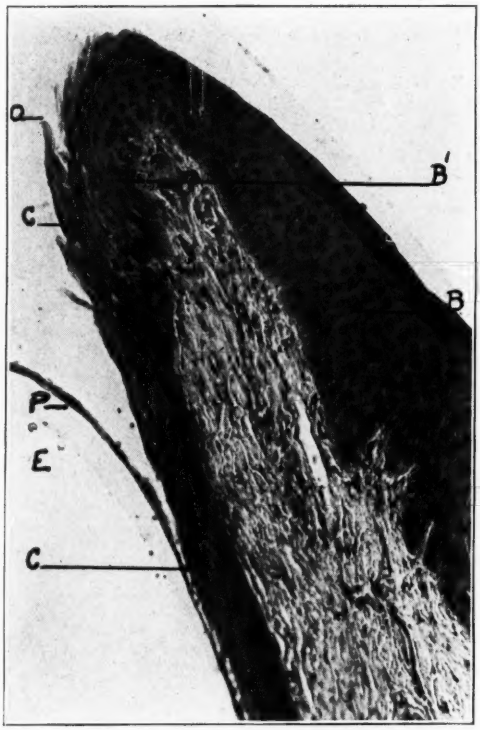

Fig. 5.—Labial gingival margin of young dog. *B*, mouth epithelium on oral surface of gingiva. *B*', proliferating mouth epithelium. *C*, epithelial attachment partly desquamated at the crest. *E*, enamel space. *P*, primary cuticle and surface cell layers separated possibly artificially from main portion of epithelial attachment.

The interproximal area in the dog has not been studied sufficiently as yet to war-

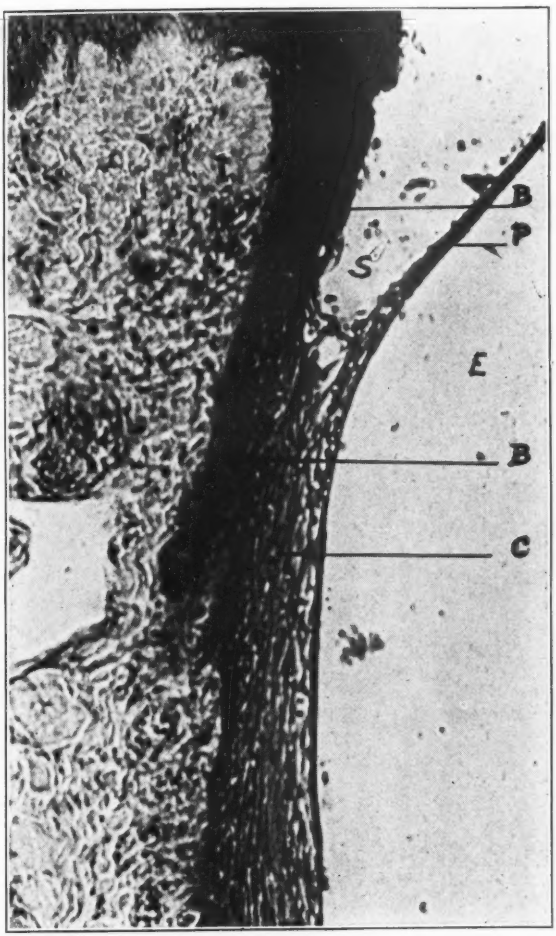

Fig. 6.—Labial gingival margin of dog. *B*, proliferating mouth epithelium. *P*, primary cuticle to which adheres some of the atrophied cells of the epithelial attachment *C*. *S*, pocket presumably formed by desquamation of the epithelial attachment in this area. *E*, enamel space. *I*, infiltration of the subepithelial tissue in the region of the pocket. Degenerative changes are observable in the epithelial attachment, *C*.

rant its discussion. Becks indicates that the mouth epithelium is present in both the dog and the monkey. Although I have not up to the present observed a proliferating mouth epithelium in this area, it is difficult to decide whether or not it is present in view of the fact that, on the other surfaces, it is very frequently indistinguishable. It is quite possible that conditions here may not

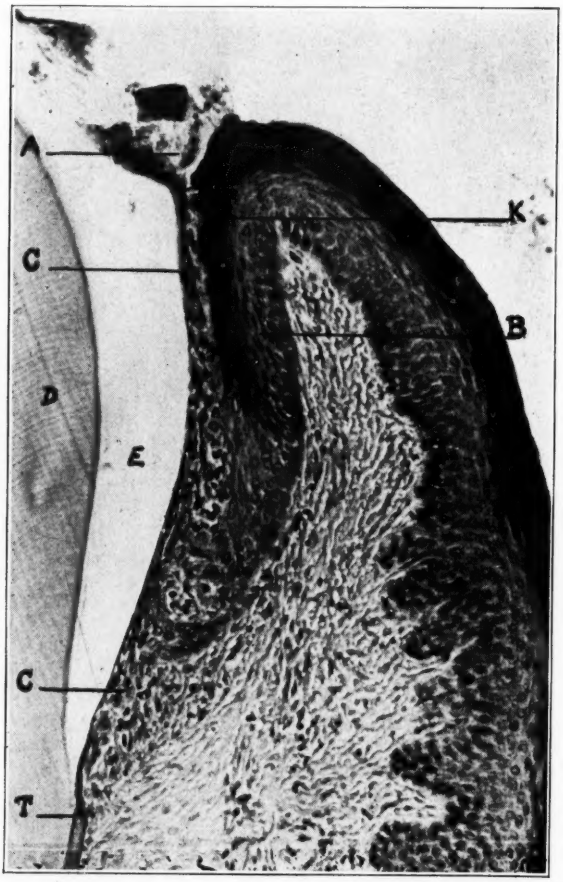

Fig. 7.—Lingual gingiva of rat molar; early development of the pathologic pocket. *A*, shallow pocket in the epithelial attachment, occupied by organisms, cell débris and calculus. *C*, epithelial attachment terminating at the enamel-cemental junction *T*. *B*, proliferating mouth epithelium with its well-developed keratinized layer, *K*. There is slight proliferation of the basal layers of the epithelial attachment. No inflammatory reaction is present subepithelially. *D*, dentin. *E*, enamel space.

correspond to those in the rat, mainly because of the difference in the plan of eruption of the teeth. In the rat, all the molars erupt closely together, while in the dog as in man, eruption is more irregular. Therefore, the interval between the eruption of one tooth and of another may be sufficient to give the mouth epithelium an opportunity, at least, to begin growth. What may happen later is a question which, with many other problems, is open to investigation.

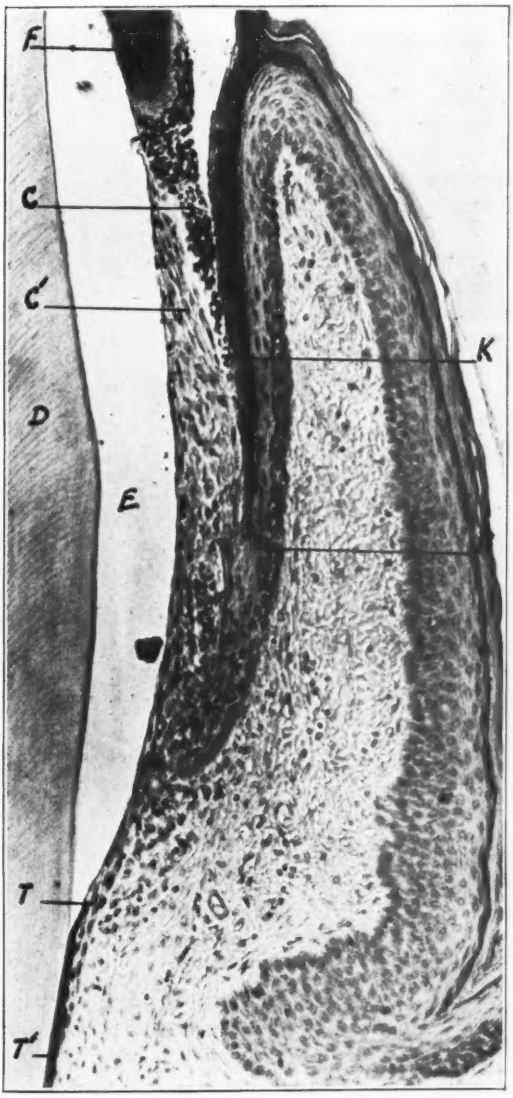

Fig. 8.—Labial gingiva of rat molar; further development of the pathologic pocket. *F*, calculus. *C*, infection and necrosis of the epithelial attachment C^1, which has grown down the root from the enamel-cemental junction *T* to T^1. *B*, proliferating mouth epithelium with its keratinized layer at *K*. There is no inflammatory reaction subepithelially. *D*, dentin. *E*, enamel space.

RELATION OF NORMAL CHANGES TO PATHOLOGIC CONDITIONS

From the observations which have been made up to date, there seems to be a very definite relation between these normal changes, particularly those of degeneration of the epithelial attachment and proliferation of the mouth epithelium, and the development of the pathologic pocket and involvement of the subepithelial tissues. The findings here tend to support in general the views of Becks.

It would seem clear that the degenerating epithelial attachment is an area of low resistance and as such would be subject to infection. This Becks contends is the case. It is not surprising, then, to find innumerable instances in which an infective process is occurring, and in which necrosis of the epithelial attachment and calculus formation are taking place as a result of infection. Furthermore, it almost seems that pocket formation, in the rat at least, occurs only because of the pathologic dissolution of the epithelial attachment. The injurious effects of food trauma which occur so frequently in the rat have been discounted throughout this discussion.[4] It has been pointed out that apparently no pockets exist in the rat under normal conditions. On the contrary, they do occur in the presence of pathologic conditions, and the question arises as to which appears first, the pocket or the pathologic condition. Orban and Mueller[5] state that the pocket is always a dirty area, and the inference in general is that it is a dirty, infected area, because it is not attached. Is it not possible that very frequently it may be both a pocket and infected for one and the same reason; namely, that infection has been at the bottom of its development, and that without infection (or injury), there would exist no pocket? Such at least is the feeling that one gets in studying this situation, particularly in the rat, but the question is still open to investigation.

Figure 1 illustrates normal conditions on the buccal or lingual surfaces of the teeth of the rat. Figures 7-10 illustrate the development of pathologic pockets and conditions on the same surfaces in the same animal.

In Figure 7, there is to be seen a very shallow pocket (*A*) in the epithelial attachment. This is occupied by microorganisms, cell débris and calculus. The pocket has deepened considerably in succeeding instances. In Figure 8, considerable necrosis (*C*) of the epithelial attachment (C^1) has occurred. Toward the crest of the gingiva, this necrotic tissue has become calcified (*F*). In Figure 9, atrophic cells and calculus principally occupy the pocket, and the same thing is true in Figure 10.

In part, the deepening of the pocket has evidently been counterbalanced by a shifting of the area of attachment and of the gingival crest. This is noticeably so in Figures 9 and 10. In the former, the epithelial attachment has grown along the root from *C*, the enamel-cemental junction, to C^1, and the crest of the gingiva is relatively closer to the latter point than it is in Figures 7 and 8. In Figure 10, the whole structure has moved apically from the enamel-cemental junction (*T*). Such situations have been considered by Gottlieb, and with justification, as being the more favorable ones. These changes lessen the depth of the pocket, reducing the infection-breeding area.

These changes do not play any particular rôle in delaying or preventing involve-

4. Gottlieb, Bernhard: Vierteljarsschr. f. Zahnhlk., 1922, p. 273-291.

5. Orban, Balint, and Mueller, Emil: Gingival Crevice, J. A. D. A., 16: 1206-1242 (July) 1929.

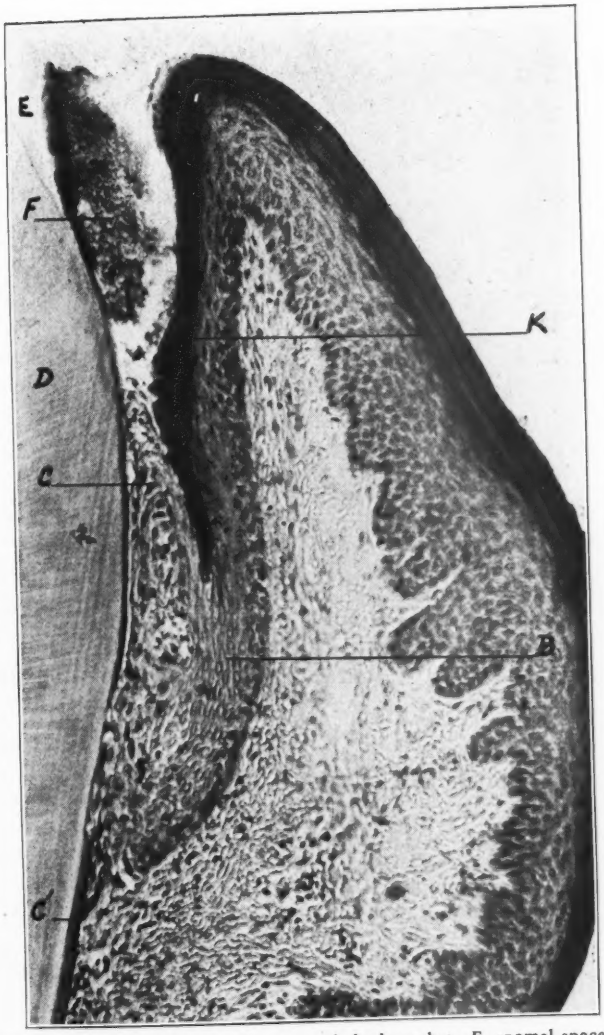

Fig. 9.—Buccal gingiva of the rat molar; a pathologic pocket. *E*, enamel space. *F*, calculus and cell débris in the region once occupied by epithelial attachment which now has grown along the root from about *C* to C^1. *B*, proliferating mouth epithelium with its keratinized layer *K* forming the outer wall to the pocket. There is no inflammatory reaction in the connective tissue. The gingiva has progressively receded (?). The bottom of the pocket is close to the enamel-cemental junction *C*. *D*, dentin.

ment of the subepithelial tissues; which, after all, is the important thing. With infection of the epithelial attachment, in other words, with the development of a

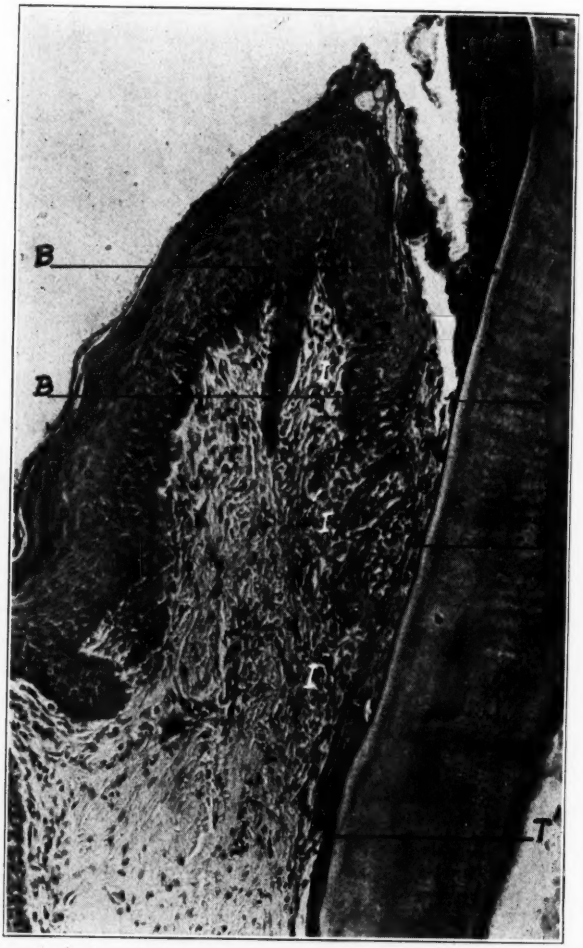

Fig. 10.—Lingual gingiva of the rat molar; an advanced pathologic pocket with involvement of the subepithelial tissue. *T*, enamel-cemental junction. *F*, calculus occupying the pocket. *B*, proliferated mouth epithelium which is not keratinized and which terminates near the bottom of the pocket *S*. *C*, epithelial attachment, which exhibits proliferation and terminates at T^1. *I*, inflammation in the connective tissue.

pathologic pocket, involvement of the connective tissue seems almost inevitable. In the rat, the proliferated mouth epithelium seems to prevent this, probably by virtue particularly of its well-developed keratinized layer. Apparently, as long as this tissue intervenes between the area of infection in the pocket and the connective tissue, no involvement of the latter occurs. (Figs. 7-9.) The well-keratinized mouth epithelium (*B*) lies between the pocket and the connective tissue, and extends for

some distance below the bottom of the pocket. So, too, does its keratinized layer (*K*). In none of these instances can any sign of inflammation be discovered in the subepithelial tissue.

On the other hand, in Figure 10, the connective tissue has become involved, there being a noticeable cellular infiltration (*I*) adjacent to the epithelium. The bottom of the pathologic pocket (*S*) is on a level with the deepest point of growth of the mouth epithelium (*B*). The epithelial attachment (*C*) only intervenes between the bottom of the pocket and the connective tissue. The proliferated mouth epithelium in this instance does not exhibit the usual keratinized layer; its surface, on the other hand, is undergoing atrophy. Both these things probably account for the involvement of the subepithelial tissue; neither of the epithelial tissues affords effectual protection. It would seem that here the pathologic process has overtaken or interfered with the normal process of change, and the underlying tissue has become affected as a result.

Two things seem to stand out from this: (1) the epithelial attachment not only is subject to infection, but also has few protective qualities by which the underlying connective tissue may be safeguarded, and (2) the involvement of the latter is only hindered or prevented by the proper growth of the mouth epithelium. In other words, it is possible to have a pathologic pocket without involvement of the subepithelial tissues if the mouth epithelium intervenes. Possibly, it is equally necessary that a keratinized layer develop on the latter. This seems to be borne out by what occurs in the interproximal area of the rat, and, to some extent, by what happens in the dog.

In the interproximal area in the rat, the degenerating epithelial attachment is almost universally subject to infection. It is difficult to find a single specimen, even in comparatively young animals, in which some necrosis of the epithelium has not occurred. Figure 3 illustrates conditions in a 25-day-old animal. Atrophy of the epithelial attachment may be observed in the region of C^1, the crest of the gingiva. Above this, calculus (*F*) and necrotic areas intermingle. Necrosis is also taking place along the sides of the gingiva (C^2). There is already (*A*) slight infiltration of the connective tissue (*I*) and proliferation of the basal layers of the epithelium. Apparently, the epithelium affords little protection to the underlying tissue.

Figure 11 illustrates a decided pathologic condition, yet a very common one. The whole structure (*C*) which was at one time epithelium is now a necrotic mass. Only a relatively small part of the epithelial attachment, that toward the enamel-cemental junction, still remains intact (C^1). The connective tissue exhibits a definite inflammatory reaction (*I*).

Apparently, then, the epithelium in the interproximal area of the rat is not only subject to infection, but also affords little or no protection to the connective tissue. There is no mouth epithelium in this area to back up the epithelial attachment, which fundamentally is an area of low resistance. If the situation in the human being is found to correspond at all with that of the rat, may not such conditions help to explain the greater frequency with which disease seems to affect the interproximal area?

As has been indicated, pocket formation in the dog seems to be due to desquamation of the degenerating epithelial attachment. If this is so, then the pocket is the first to appear. There may, of course, be something behind this desquamation which at present is not apparent. Infec-

Fig. 11.—Interproximal gingiva of the rat molar; pathologic condition. *C*, necrotic epithelial attachment. *C*[1], vital epithelial attachment. *E*, enamel space with decalcified remnant of enamel. *D*, dentin. *I*, inflammation in the subepithelial tissue.

tion, injury or both may play a part, but, at present, the evidence is not sufficient to draw any conclusions. This was not the primary objective of this presentation, which was only to show something of the rôle played by the epithelium, as it is now

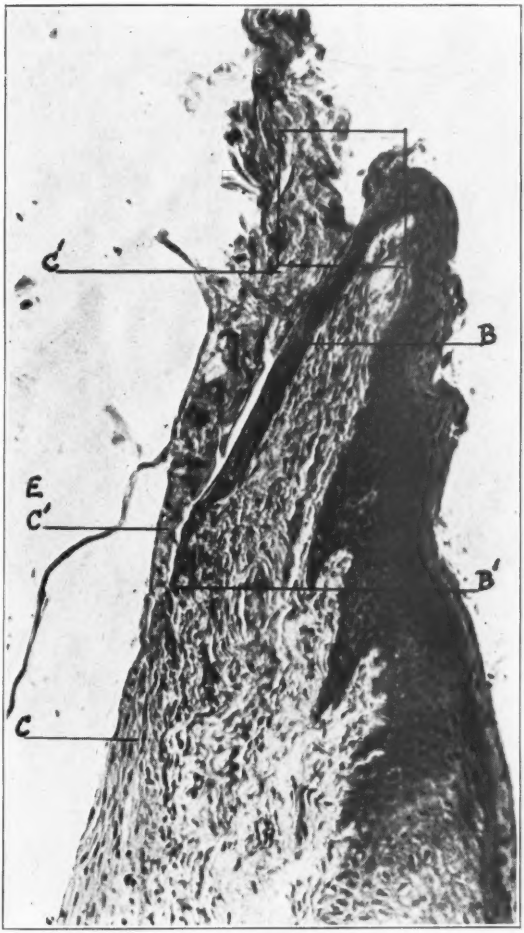

Fig. 12.—Labial gingiva of the dog; pathologic condition. C^1, desquamating and infected epithelial attachment. *C*, intact epithelial attachment. *B*, proliferating mouth epithelium terminating at B^1, at which point the connective tissue is inflamed. *E*, enamel space. (See segment, Fig. 13.)

known to be arranged, in resisting the spread of infection.

In Figure 12, which illustrates the labial gingiva of the dog, a fairly deep pocket is apparently developing as the result of desquamation of a considerable part of the epithelial attachment (C^1). This loosened and desquamating tissue as a whole is undergoing atrophy and is infected. (Fig. 13.) Apparently, because

Fig. 13.—Higher magnification of the crest of the gingiva shown in Figure 12. *B*, proliferating mouth epithelium. *O*, organisms in and around the desquamating, degenerating epithelial attachment.

of this disarrangement the connective tissue has been opened to the infection which is present in the area. Nominally, pocket development has outrun the normal cycle of change. The proliferating mouth epithelium (*B*), on which, seemingly, dependence must be placed for the protection of the connective tissue, terminates in a

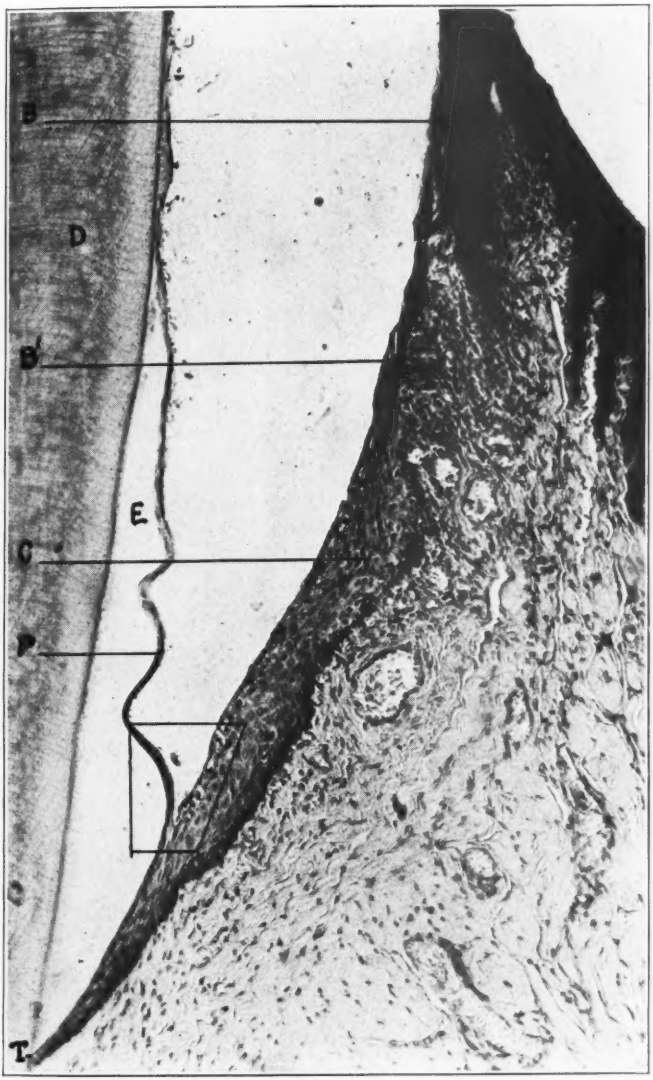

Fig. 14.—Labial gingiva of the dog; intra-epithelial separation; pathologic condition. *B*, proliferating mouth epithelium terminating at B^1, adjacent to which point there is subepithelial inflammation and congestion. Above B^1, the epithelial attachment has disappeared. *C*, intact but degenerating epithelial attachment. *D*, dentin. *E*, enamel space. *P*, primary cuticle with surface layers of epithelial attachment adhering. *T*, enamel-cemental junction. (See segment of bottom of pocket, Fig. 15.)

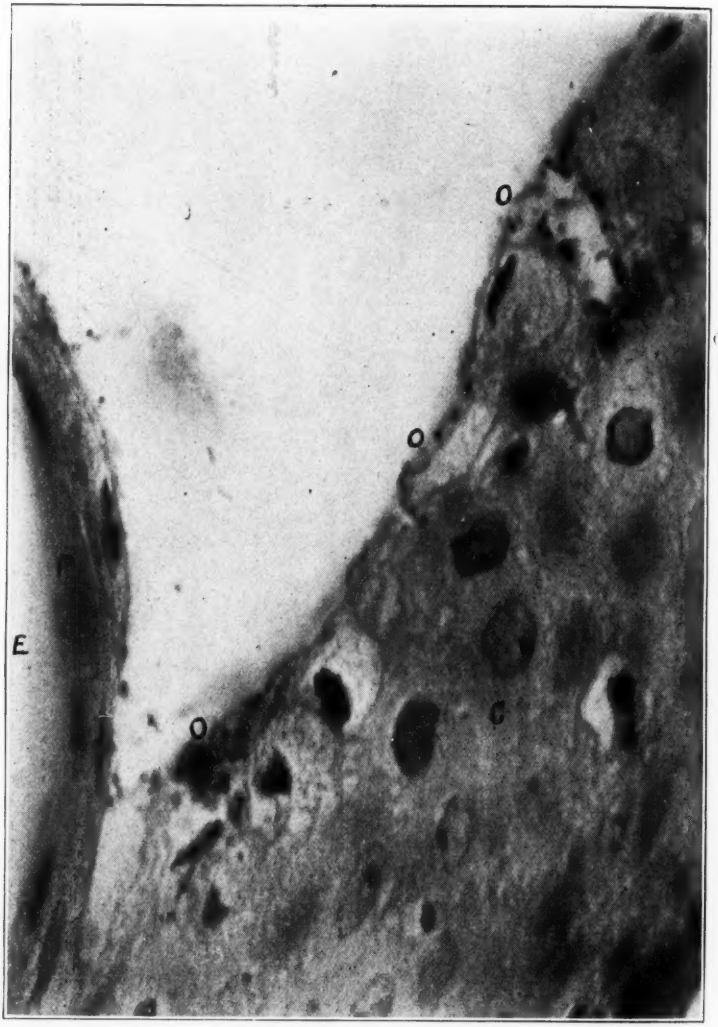

Fig. 15.—Higher magnification of bottom of pocket shown in Figure 14. *E*, enamel space. *P*, primary cuticle with surface layers of epithelial attachment *C* adhering. *O*, organisms penetrating the degenerating epithelial attachment.

thin, weak margin at B^1. At this point the connective tissue exhibits an inflammatory reaction, slight it is true, but nevertheless important, considering future possibilities. Figure 13 shows a part of this area, and in it numerous colonies of organisms (*O*) may be seen occupying the crevice between the mouth epithelium

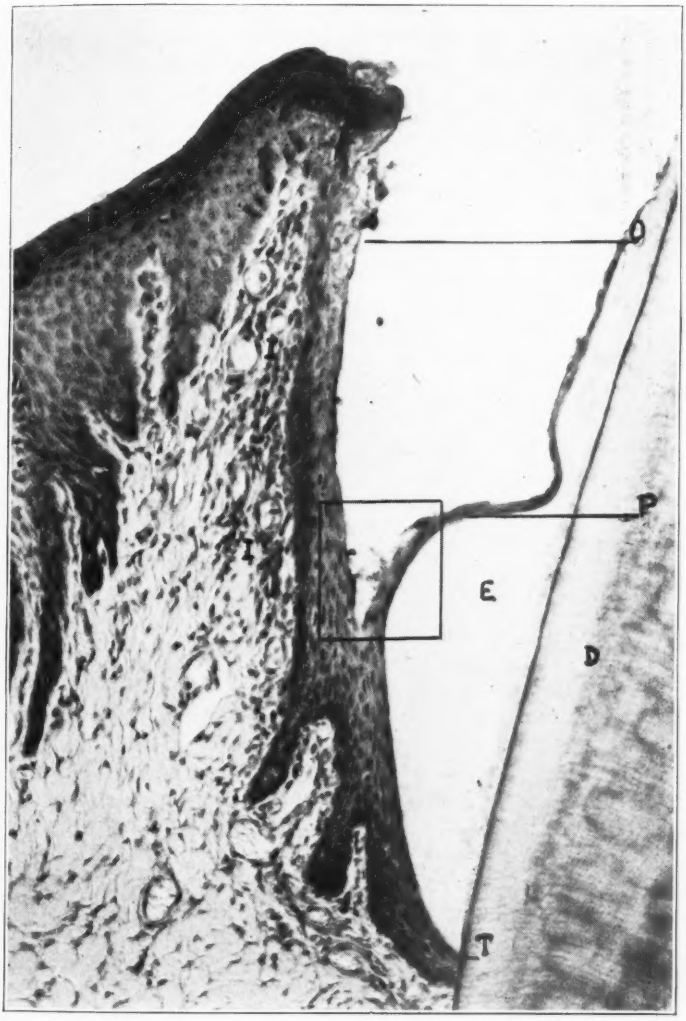

Fig. 16.—Buccal gingiva of the dog; intra-epithelial separation, pathologic condition. Proliferating mouth epithelium cannot be distinguished from epithelial attachment. *O*, region of infection and atrophy of the epithelium. *P*, primary cuticle with surface layers of epithelium adhering. *E*, enamel space. *D*, dentin. *T*, enamel-cemental junction. *I*, inflammation and congestion in subepithelial tissue. (See segment of bottom of pocket, Fig. 17.)

(*B*) and the atrophied, desquamating epithelial attachment (*C*), as well as the body of the latter.

Figures 14 and 16 illustrate rather deep pockets of the nature of the so-called intra-epithelial separations or tears

(Weski[6]). Apparently, from the evidence now at hand, these are not uncommon in the dog, and the previous example may be one such. These pockets are generally viewed as artefacts formed during the preparation of the material; but, in these particular instances and in many others, such evidently is not the case. They may exist *in vivo*, and it is just possible that they may explain the fact, which has stood so greatly in the way of a general acceptance of the idea of gingival attachment, that, clinically, there seem to exist rather deep pockets in the normal-appearing mouth.

A discussion of what may be behind the formation of such pockets is dismissed at this time: at best, it is uncertain. What is important now is the fact that here exist, nominally, deep pockets which are infected, and that, in their formation, the subepithelial tissues have become involved. Again, the normal scheme of things has been interfered with, and the structural arrangement and development of the epithelium is such as to offer poor protection against the infection present in the pocket.

These examples were chosen not only because they demonstrate the relation which exists between the pocket, the epithelial arrangement and the connective tissue, but also because they emphasize the dangers involved in injuring and tearing the gingivae.

In Figure 14, the bottom of the pocket lies fairly close to the enamel-cemental junction (T). At P is the primary cuticle, with two or three of the superficial layers of the epithelial attachment (C) adhering to it. The surface of the latter shows degenerative changes. (Fig. 15.) The proliferating mouth epithelium (B) terminates (B^1) in an extremely thin layer of cells, and its point of union with the epithelial attachment is weak. From the latter point to the crest, the epithelial attachment is missing. The connective tissue, particularly in the neighborhood of B^1, exhibits a definite inflammatory reaction and congestion. Figure 15 shows colonies of organisms (O) occupying the pocket and penetrating the epithelial attachment. The rest of the pocket is in the same condition.

Figure 16 shows very similar conditions. The tear here has cut more deeply into the epithelium but the bottom of the pocket does not lie quite so closely to the enamel-cemental junction (T). This is one of those instances in which the proliferating mouth epithelium cannot be distinguished from the epithelial attachment. At P is the primary cuticle with the superficial layers of the epithelium adhering to it. The whole epithelial surface, from the crest to the bottom of the pocket, is covered with micro-organisms. Figure 17 represents a segment from the bottom of the pocket and shows colonies of organisms (O) adhering to the epithelial surfaces and in places penetrating the substance of the epithelium. In the region of O, Figure 16, the epithelium is undergoing degeneration. The subepithelial tissue exhibits congestion and a definite cellular infiltration. Evidently the epithelium here, although in its arrangement apparently much more nearly intact than in any of the previous instances, is not serving as a very efficient protection. It is quite possible that here the mouth epithelium has failed to proliferate, and that, as is usual, the degenerating epithelial attachment which alone then must serve as a covering to the connective tissue, fails to inhibit the spread of the infection which is present in the pocket.

6. Weski: Vierteljarsshr. f. Zahnheilk., 1921, p. 37; 1922, p. 28.

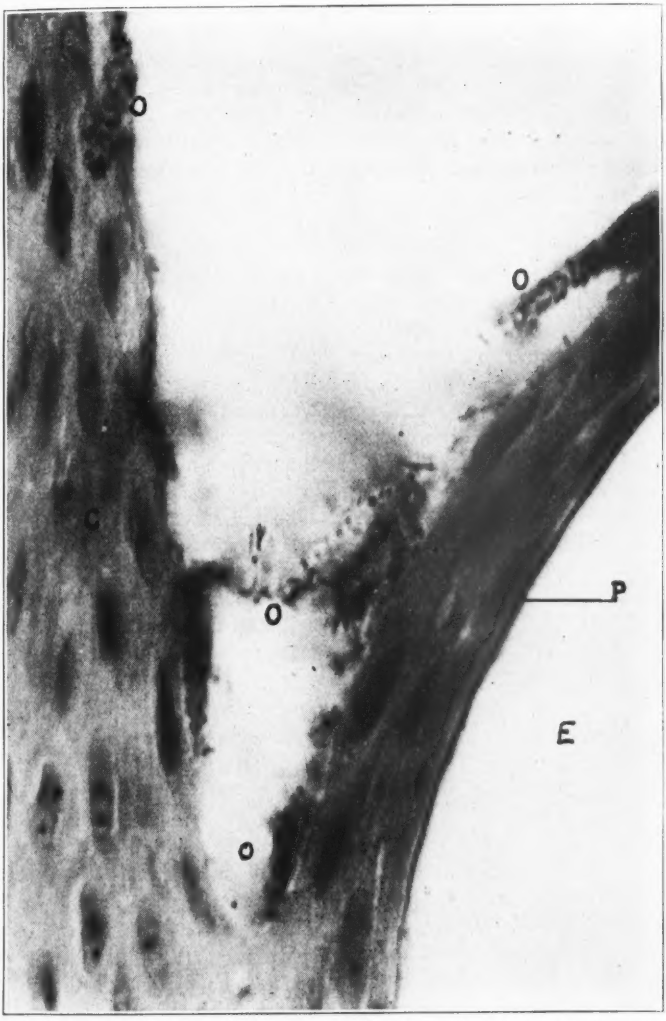

Fig. 17.—Higher magnification of bottom of pocket shown in Figure 16. *E*, enamel space. *P*, primary cuticle with surface layers of epithelial attachment (*C*) adhering. *O*, organisms in pocket and penetrating epithelium.

SUMMARY

The essential features presented in this discussion are chiefly three in number, namely, what constitutes the normal structure of the interproximal gingivae in the rat molars; the changes which occur normally in the labial, buccal and lingual gingivae of the dog, and, lastly, the relation which seems to exist between the epithelium of the gingivae and the

development and progress of pathologic change in the gingivae.

It was shown that, in the rat molar region, the structure of the interproximal gingivae apparently differed from that existing on other surfaces. Whereas, in the latter, one of the outstanding characteristics was the proliferation of the mouth epithelium downward behind the epithelial attachment, in the former this did not, apparently, take place. Only the enamel epithelium (epithelial attachment) seemed to serve as an epithelial covering on the interproximal gingivae.

Although an adequate explanation for the atrophy of the epithelial attachment which regularly occurs as a normal process on the buccal and lingual surfaces is still wanting, the reasons for this occurrence on the interproximal surfaces seem clear. Chiefly, it is because it is, in its anatomic arrangement between the approximating teeth, cut off from the circulation.

It was also shown that much the same changes took place on the labial, buccal and lingual surfaces of the dog as occurred on corresponding surfaces in the rat. The whole process was not so clear cut in the dog. Frequently, it was difficult to distinguish between the proliferating mouth epithelium and the epithelial attachment. Furthermore, the proliferating mouth epithelium apparently did not keratinize. Apparently, also, the degenerating epithelial attachment toward the crest of the gingiva underwent desquamation and this resulted in the formation of a pocket which occupied a position between the primary cuticle on the one hand and the proliferated mouth epithelium on the other. (The interproximal area in the dog has not been sufficiently investigated as yet.)

It was indicated that the epithelial attachment, as Becks has stated, was an area of low resistance. Infection occurred quite frequently in this tissue; in the interproximal area, almost constantly. Indeed, on the buccal and lingual surfaces of the teeth of the rat, pocket formation, in the absence of signs of trauma, seemed to occur only as a result of infection in this tissue.

It was further indicated that the epithelial attachment alone seemed to afford little protection against the spread of infection into the subepithelial tissue. The proliferated mouth epithelium was the thing which hindered this, and its efficacy seemed to be increased by the keratinization of its surface. Thus, in the rat, much more severe pathologic conditions could exist in the pocket on the buccal or the lingual without involvement of the subepithelial tissue than was the case on the interproximal surfaces.

Finally, it was indicated that as long as the rate of development of the pathologic pocket, regardless of what might be behind it, did not transcend the normal growth and development of the mouth epithelium, the probable involvement of the subepithelial structures was delayed and minimized, if not entirely prevented.

At least one definite conclusion may be drawn; namely, that the shallower the pocket, the better the chance that the subepithelial tissues will not become involved. This, after all, is the important thing. Therefore, every means should be taken to preserve intact the arrangement of the gingivae.

SOME ASPECTS OF TREATMENT AND RETENTION IN ADULT AND ADOLESCENT CASES*

By VICTOR LAY, D.D.S., Buffalo, N. Y.

IN the course of his work, the orthodontist is frequently asked whether his treatment may be successfully applied to adults. There are also many adolescents driven to apply for treatment as facial deformity becomes increasingly evident. While the prognosis is very often unfavorable, it must be modified to except certain select cases between the ages of 15 and 30 years of age, where much can be done to alleviate the disfiguring conditions. Whereas, the actual moving of the teeth is not impractical, the conservative orthodontist has often discouraged the prospective patient on account of the difficulty of retention.

Present day social standards have increased the individual's consciousness of physical defects, so that a facial disharmony may cause one so afflicted to suffer a great deal mentally. It may also serve to retard the individual's advance in the world of affairs. Thus, it becomes evident that if the orthodontist can render service in certain of these cases, he will benefit the patient, and reflect credit on himself and the profession that he represents.

In well-selected cases, there are several methods of procedure that make it possible to render aid. These are listed as follows: 1. Judicious extraction, to gain space and eliminate the need of excessive and impractical lateral expansion of the dental arches. 2. Insertion of artificial teeth as permanent retainers, to hold natural teeth that have been moved to correct position. 3. The use of removable retaining appliances to be worn only at night, for an indefinite period. At times, it may be advisable to combine these several items of treatment to secure the desired result.

As regards the first mentioned procedure, the extraction of certain teeth in cases otherwise impractical to treat, some explanation may be apropos. The size and shape of the teeth and dental arches are determined by two factors, heredity and function. Heredity must be acknowledged to exert a powerful influence. Calvin Case[1] has this to say, in discussing biologic laws: "There is every reason to believe from the most advanced authorities on biology, that the bones of individuals cannot be forced to grow larger than their inherited sizes, nor would they have ever grown larger than any fixed primitive state, had it not been for the laws of natural variation and survival of the fittest."

The following quotation from Stackpole's biology should set at rest the fantastic theory of bone growth. "It is well known that all animals and plants have a definite limit of growth." This applies

*Read before the Section on Orthodontia at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

1. Case, C. C.: Dental Orthopedia, Ed. 2, 1921, pp. 56-57. (Published by author.)

to parts of the individual, as well as to the whole structural unit.

Quoting from an article by Clyde B. Keeler[2] on "Heredity and Its Relation to Dentistry," we find the following statement: "Crosses between Scotch and Japanese have been observed, and in the second generation numerous mental and

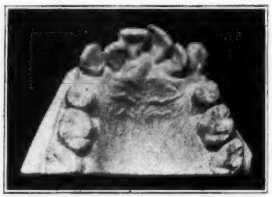

Fig. 1.—Extraction in young adult to permit alinement of six anterior teeth.

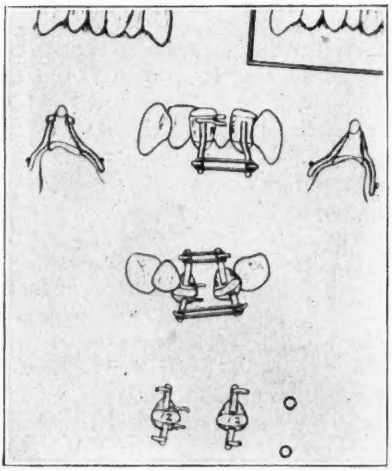

Fig. 2.—Bodily movement of incisors to close space left by extraction in mature arch.

structural disharmonies occur; the latter including small teeth in large jaws and large teeth in small jaws."

2. Keeler, C. B.: Internat. J. Orthodon., 15:445 (May) 1929.

So much for heredity; now, to consider briefly the effect of function: Function determines form, whether it be that of an airplane, a submarine or an animal organism or the component parts of that organism. Faulty or perverted function results in modified form. Diminution of functional activity results in reduced size of the functioning parts. In many adults, we find dental arch forms seemingly inadequate to accommodate the tooth structure which Nature has placed there. The result is an overcrowded condition, leading to tissue tension, expressed in terms of traumatic occlusion, periodontoclasia or decay from faulty contacts.

Many of these conditions can be forestalled or relieved by judicious extrac-

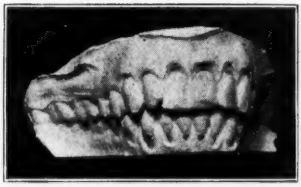

Fig. 3.—Periodontoclasia of labial process, due to forward growth-stress of narrow arch (third molar pressure).

tion of certain teeth. It is often possible to aline the remaining teeth by using the space thus gained, where otherwise it would be impractical and impossible to relieve the existing conditions. Some cases in which relapse has occurred and which have been treated at a favorable age, but in which the patient suffers from a bad heredity manifesting itself in the adult denture, may be helped by judicious extraction and realinement. Cases involving impaction form a large percentage of those subject to extraction.

Very commonly seen in adults is the overcrowding of mandibular incisors. The condition often results in gingivitis,

Vincent's infection or periodontoclasia. If the crowding be not due to third molar pressure or if removal of the third molar does not help it, the extraction of the incisor which is most out of alinement may be beneficial. The resulting space

Unsightly gingival recession on the labial surface of maxillary anterior teeth may be due to the advanced position the teeth occupy in the process. The labial plate of process, being paper thin, recedes owing to the forward position of the

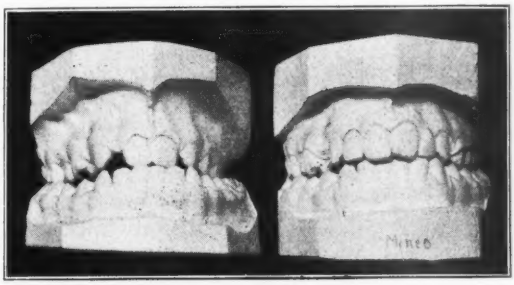

Fig. 4.—Models showing opening of lateral spaces and insertion of artificial teeth; left, before treatment; right, after treatment.

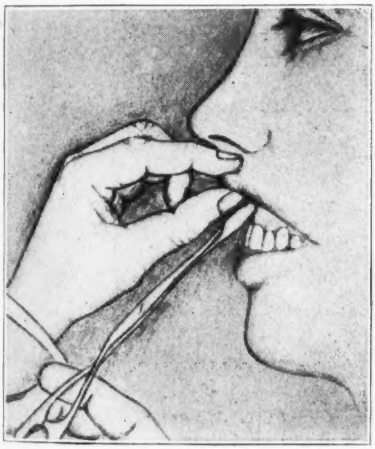

Fig. 5.—Use of hemostat in removal of abnormally large labial frenum.

may be closed by a bodily movement of the teeth adjacent to the space. This may be accomplished by the method given in Case's textbook[3] and shown in Figure 2.

3. Footnote 1, p. 351.

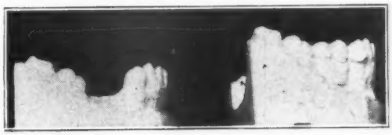

Fig. 6.—Space opened (left) for insertion of artificial teeth (right).

teeth. Narrow arches being forced forward by growth stresses often present this picture. If there are pulpless bicuspids or molars present, it may be helpful to extract them, thus relieving the tension and affording an opportunity to aline the anterior teeth to a position of improved mechanical advantage.

Passing on to the second item of treatment, the insertion of artificial teeth as permanent retainers, we find the method most applicable where there appears for some reason an excess of space which must be closed and kept closed. Whereas no great difficulty is experienced in closing the spaces, the closure must be main-

acceptable physiognomy and socially embarrassing disfigurement.

The removable vulcanite retainer as elaborated by C. A. Hawley[6] has marked the greatest single advance in the art of retention, and has been more extensively employed than any other one device for posttreatment maintenance. When this retainer is to be employed for an indeterminate period, some modifications may be made in the material and form, for the following reasons: 1. Use of a cast gold base will greatly reduce its bulk. 2. Gold, being cleaner and less bulky than vulcanite, is favorable to maintenance of mouth hygiene. 3. If the labial wire is broken, a repair is made much more quickly by soldering; which is not always the case with vulcanite. Ernest N. Bach,[7] of Toledo, Ohio, has advocated the use of cast gold retaining plates for certain cases, and the use of this method will probably increase with the years as ortho-

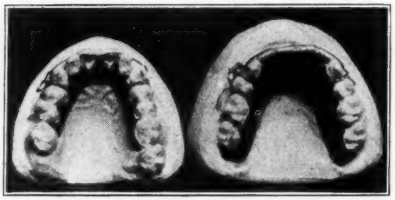

Fig. 11.—Comparison of bulk as between cast gold retainer and vulcanite retainer.

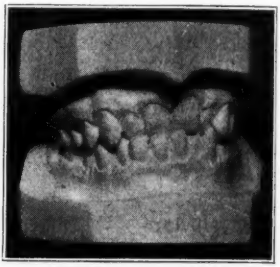

Fig. 12.—Maxillary incisors in malposition.

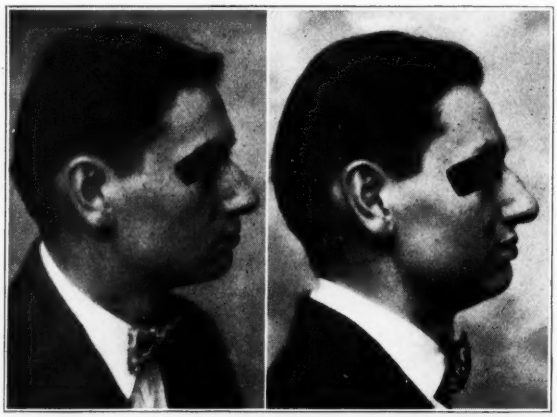

Fig. 13.—Facial view of patient the model of whose teeth is shown in Fig. 12; left, before and, right, after correction. No retainer was necessary.

6. Hawley, C. A.: Internat. J. Orthodon., 11:315 (April) 1925.

7. Bach, E. N.: Internat. J. Orthodon., 13: 987 (Nov.) 1927.

dontists realize the value of its application in long periods of retention.

So far, we have considered only those cases which, when corrected, will not be maintained by the forces of occlusion. There are many older cases which can be successfully treated because the corrected teeth are automatically maintained in position by the occlusion. This applies to both labial and buccal teeth.

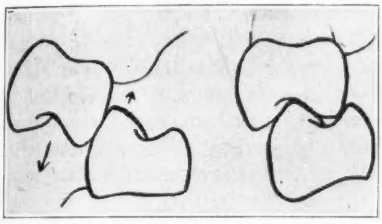

Fig. 14.—Condition before and after correction of extremely pernicious buccolingual malocclusion (self-retaining).

Buccal teeth are sometimes in a position of buccolingual malocclusion, where the occlusal surfaces do not meet, but pass each other when the dentures are in contact. Bringing these morsal surfaces into correct antagonization will prevent serious trouble periodontically. Correction will also aid mastication and prevent premature settling of the vertical height of the bite. From a mechanical and physiologic standpoint, this type of correction is highly desirable, especially as it is self-retaining.

SUMMARY

While the treatment of patients past the accepted age for orthodontia does not always present a favorable prognosis, there are certain cases wherein a great improvement is possible, provided the limitations imposed by age are well understood.

The cases should be carefully selected by the orthodontist, with the cooperation of the patient and the patient's dentist practically assured.

It is the duty of the orthodontist to render aid wherever there is a possible chance of a creditable result.

40 West North Street.

FURTHER STUDIES OF THE ETIOLOGY AND CONTROL OF DENTAL CARIES*

By PHILIP JAY, D.D.S., and ANN ESSER, D.H., Rochester, N. Y.

IN the previous publications, we have reported the close correlation between the incidence of *Bacillus acidophilus* in the human mouth and the occurrence of dental caries.[1] Aside from the persistent occurrence of this organism in dental caries, it was observed that mouths previously free of the disease became infected with *Bacillus acidophilus*

*Aided by a grant from the Rockefeller Foundation.

*From the Department of Bacteriology, School of Medicine and Dentistry, University of Rochester and the Rochester Dental Dispensary.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 8, 1929.

1. Jay, Philip, and Voorhees, R. S.: Bacillus Acidophilus and Dental Caries, Dent. Cosmos, 69:977 (Oct.) 1927. Jay, Philip: Bacillus Acidophilus and Dental Caries, J.A.D.A., 16:230 (Feb.) 1929.

at least three months prior to the clinical manifestation of dental lesions.

From time to time, there have appeared in the literature, statements to the effect that *Bacillus acidophilus* is a normal inhabitant of the mouth and that it can be isolated at will from any individual regardless of the presence or absence of dental caries. In the search for aciduric bacteria in the mouth, it is customary to employ mediums of acid reaction in order to eliminate the hosts of organisms present in the mouth which cannot survive an acid environment. It is generally agreed that while *Bacillus acidophilus* will tolerate an acidity of p_H 4 or 5 very well, it grows best in mediums adjusted to the neutral point. With this in mind, we took duplicate cultures in each case, employing both the acid and the neutral mediums. A sterile explorer was passed over the exposed surfaces of all of the teeth. The material so collected was shaken off into a small serologic tube containing 2 c.c. of sterile physiologic sodium chlorid solution. After a thorough shaking, equal amounts of the inoculated solution were transferred by means of sterile pipets, to tubes of glucose broth p_H 5 and p_H 7, respectively. After a forty-eight-hour incubation period at 37.5 C., the cultures were examined for *Bacillus acidophilus*.

In no instance, with this technic, did we fail to obtain the organism in the p_H 5 broth when the p_H 7 was positive. Conversely, in several instances, the p_H 7 cultures were negative though the corresponding p_H 5 cultures were positive. Apparently, in these cases, the aciduric bacteria were overwhelmed by the numerous organisms which were able to grow in the neutral broth. McIntosh, James and Lazarus-Barlow reported similar findings in 1922.[2] After repeated check-ups, we accepted the p_H 5 broth as our standard medium, and in our routine examination of caries-free subjects, we have been able to confirm our previous findings and those of Bunting,[3] namely that *B. acidophilus* is not necessarily an inhabitant of every mouth.

From the standpoint of preventive dentistry, it would be extremely interesting to observe the relationship of dental caries to the activity of *Bacillus acidophilus* in a large group of children and to determine whether or not the disease might be decreased in occurrence or extent by therapeutic control of the caries-forming bacteria. Such a study was conducted during the past year on children in the schools of Rochester, N. Y. The results form the basis of this paper. In the approach to this study, we reviewed carefully the previous work of Bunting and others, who reported results obtained in a similar study.[4] In this experiment, they used metaphen and hexylresorcinol as therapeutic agents, and they state that, by the use of these drugs, they eradicated the bacillus from the mouth in a large percentage of cases, and that a marked

2. McIntosh, J.; James, W. W., and Lazarus-Barlow, P.: An Investigation into the Etiology of Dental Caries, Brit. J. Exper. Path., 3:138 (June) 1922.

3. Bunting, R. W., and Palmerlee, Faith: Rôle of B. Acidophilus in Dental Caries, J.A.D.A., 12:381 (April) 1925.

4. Bunting, R. W.; Nickerson, Gail, and Hard, Dorothy G.: Further Studies of the Relation of Bacillus Acidophilus to Dental Caries, Dent. Cosmos, 68:931 (Oct.) 1926. Bunting, R. W.; Nickerson, Gail; Hard, Dorothy G., and Crowley, Mary: Further Studies of the Relation of Bacillus Acidophilus to Dental Caries, Dent. Cosmos, 70:1 (Jan.) 1928. Bunting, R. W.; Crowley, Mary; Hard, Dorothy G., and Keller, Margaret: Further Studies of the Relation of Bacillus Acidophilus to Dental Caries, Dent. Cosmos, 70:1002 (Oct.) 1928.

decrease, or a complete cessation of dental caries, was noted in the individuals so treated. For the purpose of checking these observations and of amplifying the data so far presented, the study carried on in the Rochester schools was conducted along somewhat similar lines, differing only in the fact that, in the latter instance, more frequent and rigorous treatments were given and more frequent bacteriologic examinations were made.

For the purpose of this study, it was not desirable to select a group of children who were confined to one particular environment, but rather to acquire a group representative of a typical community

TABLE I.—METAPHEN TREATMENTS
(JUNE, 1929)

Case	Treatments	B. Acidophilus	New Cavities
422	49	—	0
463	48	—	0
462	49	—	1
401	48	+	1
403	48	+	1
421	49	+	1
438	48	+	2
440	48	+	1
538	48	+	2

living under average conditions, and so we were obliged to depend on what material could be obtained in the public schools. Of the 300 children between 15 and 16 years of age originally selected, we were able to keep 222 under observation during the entire school year. During September and the early part of October, each child was carefully examined for dental caries and all cavities were charted on individual history cards. Cultures were taken from the teeth each week thereafter until the end of the school year in June. At that time, they were reexamined and new points of caries were recorded on the charts.

Those who yielded two consecutive positive cultures were considered, for the purpose of this experiment, susceptible to dental caries. From this group, some were arbitrarily selected for anti-*B. acidophilus* treatment, while the remainder were kept under observation as controls. This report will deal solely with the subjects under our observation during the entire period of the experiment, that is, sixty-nine treatment cases and forty controls. The remaining 113 were not dropped but were also kept under observation and cultured each week.

Nine of the susceptible group received a rigid course of the metaphen[5] treatment. The teeth were carefully polished and metaphen 1:500 was applied topically with the hard rubber cups and carried between the teeth with dental floss. The patient was then allowed to rinse the mouth thoroughly with metaphen 1:5,000. These treatments were given on three consecutive days every week. The nine cases received an average of forty-eight applications of metaphen during the course of treatment. (Table 1.) In no instance did the cultures become exclusively negative for *B. acidophilus* during this time though in three individuals the last four cultures were negative. In these cases, but one new point of caries was found and that was a small occlusal pit in a bicuspid. All of the remaining six who had continued to give a positive reaction for *B. acidophilus* had one or more new cavities at the end of the experiment.

Another group of sixty children used S. T. 37 hexylresorcinol in a 1:3 dilution as a mouth wash two or three times a day. (Table 2.) Only fourteen of the sixty, or 23.3 per cent, gave a negative

5. Footnote 4, first reference.

reaction for *B. acidophilus.* (June, 1929.)

Of the fourteen who developed a negative reaction for *B. acidophilus,* one developed a small occlusal cavity in a maxillary first molar, and, in another, we found a small suspicious occlusal pit in a bicuspid. Forty of the forty-six showing positive reactions had developed one or several cavities during the course of treatment. In the control group of forty, fifteen became negative with no treatment whatever and twenty-five remained positive. Dental caries occurred in eighteen of the twenty-five whose reaction remained positive and in two of the fifteen whose reaction became negative.

As can be seen in Table 3, the controls, as a group, fared better than those who received treatment.

The remaining 113 children under observation may be classified, according to the incidence of *Bacillus acidophilus,* into three groups (Table 4).

Further analysis of the records of the ten children in Group III who remained free of caries revealed that the positive cultures were widely scattered or else occurred late in the progress of the experiment. From our previous studies, we assume that if they continue positive, caries will occur.

SUMMARY

The fact that, in an examination of 222 cases, *Bacillus acidophilus* was recovered from all but six mouths showing dental caries further substantiates the concept that this organism is of primary importance in the etiology of dental caries. Furthermore, it was noted that, in both the treatment and control groups,

TABLE 2.—RESULTS IN GROUP USING S. T.-37 (HEXYLRESORCINOL)* (JUNE, 1929)

No. Cases	B. Acidophilus (—)	B. Acidophilus (+)	New Cavities
60	14	..	1 + (1 pit?)
		46	40

*Dilution: 1-3, mouth wash, two or three times daily.

TABLE 3.—COMPARISON OF TREATED AND UNTREATED CASES (JUNE, 1929)

	No.	B. Acidophilus+	B. Acidophilus—	
Treated Cases	69	52	17 (24.6%)	48 (69.5%)
Controls	40	25	15 (37.5%)	20 (50%)

TABLE 4.—INCIDENCE OF B. ACIDOPHILUS (JUNE, 1929)

Group	Number	B. Acidophilus	Caries since October
I	25	All cultures negative	5 (occlusal pits)
II	67	1 or 2 positive cultures, the rest negative	6
III	21	3 or more positive cultures	11

in all those cases which became negative and remained so throughout the period of observation, there was an almost complete cessation of dental caries.

The findings relative to the effectiveness of the metaphen and hexylresorcinol as antagonists to *Bacillus acidophilus* do not agree with the published findings of Bunting and his associates. Of the cases who received anti-*B. acidophilus* treatment, only 24 per cent became negative; whereas, 37 per cent of the control cases became negative without treatment; and of the treated group, 69 per cent devel-

oped dental caries, while but 50 per cent of the control group had new cavities during the experiment.

We are free to confess that we do not understand the reasons for this discrepancy. We are fully aware that clinically marked improvement has been noted in individual cases after the inauguration of the metaphen and hexylresorcinol treatments; also that, in such a mass study, an infinite number of variables may enter which may materially alter the data obtained. For instance, the fact that a larger incidence of *B. acidophilus* and dental caries occurred in the treated groups than in the controls might be considered as evidence that the use of these drugs was actually favorable to the activity of these organisms and harmful to the individual. In view of the many variables which may have entered into this experiment, and in view of our observations of selected cases which were quite opposed to such a conclusion, we do not wish to place this interpretation on our data at the present time. In fact, we do not wish to draw any definite conclusion regarding the use of these drugs for the prevention of dental caries from this study alone. It is our opinion that further carefully controlled experiments should be conducted to determine the degree of efficacy of these and other drugs in the therapeutic control of dental caries.

DISCUSSION

Russell W. Bunting, Ann Arbor, Mich.: Dr. Jay has presented data which are the opposite of what we have seen and are seeing. I cannot account for it. How shall we interpret the fact that, in two groups of sixty treated cases and forty controls, the treated were worse off as far as caries was concerned than those that were not treated? I would call to your attention the fact that the therapeutic control of dental caries is by no means 100 per cent possible. It will only affect certain cases. I have two boys in my own family, one 16 and one 18. The younger boy can be made negative to *B. acidophilus* and kept so with little treatment. The elder boy, who has been given many treatments, has never given a negative culture. In the test tube in the laboratory, we can show that one organism will be killed by hexylresorcinol even in high dilutions, while another will not. The same thing is true of metaphen, and the two groups do not coincide. For that reason, we have recommended the use of both metaphen and hexylresorcinol, a sort of shotgun dose, to get as many of the organisms as possible. Many dentists have written in such profuse praise of what has happened in cases in their practices when metaphen and hexylresorcinol was used that I was led to believe that there might be some value in this treatment. We have perfectly open minds, and if these drugs are not valuable, we wish to know it. When we return to Ann Arbor, we will make a final check of about 500 children who have used hexylresorcinol twice daily over a period of one year. We have accurate records of each one of those cases, and we will compile the data and publish a statement as to just what happened. From what has gone before, I expect that we will find a direct benefit in about from 50 to 60 per cent of cases so treated. It might run a little higher because these children are also on a fair diet. As far as the data which Dr. Jay has presented are concerned, I am not able to visualize just what did happen in the group which he observed.

Weston A. Price, Cleveland, Ohio: What is the possibility that, in running these cultures over a period of nine months, we are really dealing with two phases in which another force is playing an important part? In about the fifteenth century, when the Black Plague was scourging England, it was discovered that when a cordon of people beating on tin pans were placed around a house, the people in that house did not get the Black Plague. They thought it had something to do with driving away evil spirits, but it had to do with the scaring away the rats that carried the infection. We are dealing here with an important but secondary incident in the development of dental caries. These studies of Dr. Jay's, if I understood him correctly, extended over nine months. If immunity and susceptibility to dental caries are influenced, as I believe they are, by vitamin factors which themselves have a rise and fall as an effect

tained by contact of all the adjacent teeth.

The disfiguring spaces have often been caused by congenital absence of the teeth, or the presence of pegshaped lateral incisors or abnormal frena. Orthodontic appliances may be useful to distribute the space correctly so that a bridge tooth may be inserted, especially when the maxillary lateral incisors are missing.

In the case of pegshaped lateral incisors, it may be advisable to apply porcelain shell crowns to close the spaces and maintain contacts. Surgical removal of an abnormal frenum may be advisble at the time of drawing together the maxillary incisors, this method being upheld by authorities on orthodontia.[4]

Owing to unavoidable extractions in the molar region, teeth have sometimes tipped so as to receive harmful stresses and to make the insertion of creditable substitutes almost impossible. Here, the orthodontist may aid by correcting the position, and opening spaces for the dentist to insert teeth of the proper form and size.

Where insertion of artificial teeth to keep the spaces closed between the maxillary anterior teeth is impossible, and it is desired merely to maintain a permanent contact, there are several methods practical: the method of Case,[5] inserting pins and a connecting link; or the use of the cast inlay process to make an interlocking construction permitting the retained teeth individual movement in their alveoli.

When six anterior teeth have been moved together, they may be held in contact by a retaining device worn nights for an indefinite period of time.

This brings us to the subject of removable retainers, worn by the patients dur-

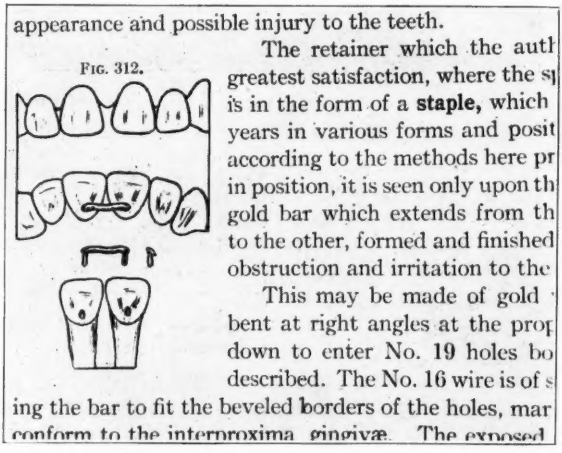
appearance and possible injury to the teeth.

FIG. 312.

The retainer which the auth
greatest satisfaction, where the sp
is in the form of a **staple,** which
years in various forms and posit
according to the methods here pr
in position, it is seen only upon th
gold bar which extends from th
to the other, formed and finished
obstruction and irritation to the

This may be made of gold
bent at right angles at the prop
down to enter No. 19 holes bo
described. The No. 16 wire is of s
ing the bar to fit the beveled borders of the holes, mar
conform to the interproxima gingivæ. The exposed

Fig. 7.—Case's method for permanently retaining proximal teeth (young adult).

4. Angle, E. A.: Treatment of Malocclusion of the Teeth and Fractures of the Maxillae, Ed. 7, Philadelphia: S. S. White Dental Manufacturing Co., 1907, p. 570. Footnote 1, p. 355. Patton, E. W.: Proc. 1st Internat. Dent. Cong., 1927, p. 701.

5. Footnote 1, p. 402.

ing the hours of rest. There are types of facially disfiguring malocclusion noticed in adolescents and adults which are considered by conservative orthodontists impractical to treat. It is possible to reduce the facial disharmony, but because the patient has passed the ideal age for treatment, the orthodontist feels that the prognosis for successful retention is doubtful.

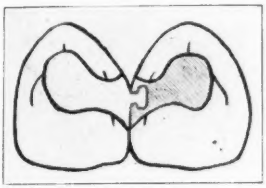

Fig. 8.—Interlocking inlays holding central incisors otherwise impossible to retain in contact.

inite time, some encouragement may be given. There are many who would be happy to embrace the opportunity to save themselves social embarrassment for life even at the cost of a virtually permanent form of retention.

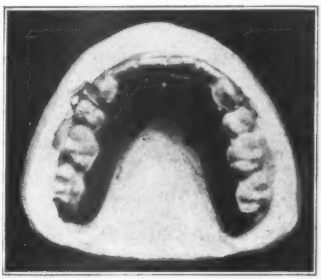

Fig. 10.—Hawley removable retainer.

Fig. 9.—Facial disharmony modified; permanent retention by removable retainer worn at night.

This would lead him to discourage the patient seeking treatment. However, the patient greatly desires relief, and if there is a direct understanding previous to treatment, the patient agreeing to wear a removable retainer nights for an indef-

The wearing of a retainer at night does not entail so much trouble as many other daily acts in the way of improving personal appearance and certainly would be faithfully done if the patient realized that it means the difference between an

acceptable physiognomy and socially embarrassing disfigurement.

The removable vulcanite retainer as elaborated by C. A. Hawley[6] has marked the greatest single advance in the art of retention, and has been more extensively employed than any other one device for posttreatment maintenance. When this retainer is to be employed for an indeterminate period, some modifications may be made in the material and form, for the following reasons: 1. Use of a cast gold base will greatly reduce its bulk. 2. Gold, being cleaner and less bulky than vulcanite, is favorable to maintenance of mouth hygiene. 3. If the labial wire is broken, a repair is made much more quickly by soldering; which is not always the case with vulcanite. Ernest N. Bach,[7] of Toledo, Ohio, has advocated the use of cast gold retaining plates for certain cases, and the use of this method will probably increase with the years as ortho-

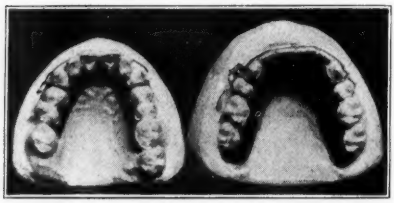

Fig. 11.—Comparison of bulk as between cast gold retainer and vulcanite retainer.

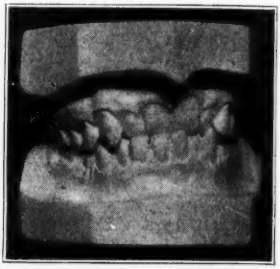

Fig. 12.—Maxillary incisors in malposition.

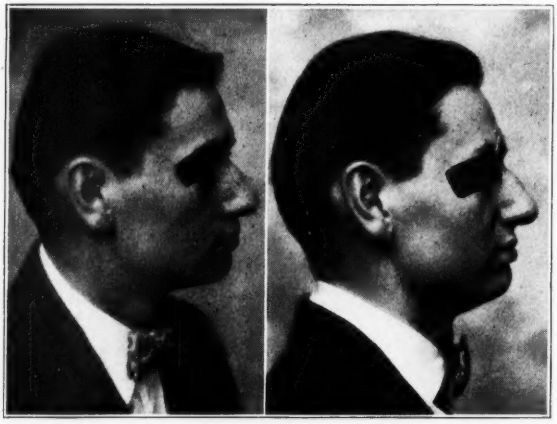

Fig. 13.—Facial view of patient the model of whose teeth is shown in Fig. 12; left, before and, right, after correction. No retainer was necessary.

6. Hawley, C. A.: Internat. J. Orthodon., 11:315 (April) 1925.

7. Bach, E. N.: Internat. J. Orthodon., 13: 987 (Nov.) 1927.

dontists realize the value of its application in long periods of retention.

So far, we have considered only those cases which, when corrected, will not be maintained by the forces of occlusion. There are many older cases which can be successfully treated because the corrected teeth are automatically maintained in position by the occlusion. This applies to both labial and buccal teeth.

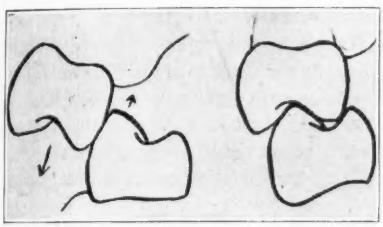

Fig. 14.—Condition before and after correction of extremely pernicious buccolingual malocclusion (self-retaining).

Buccal teeth are sometimes in a position of buccolingual malocclusion, where the occlusal surfaces do not meet, but pass each other when the dentures are in contact. Bringing these morsal surfaces into correct antagonization will prevent serious trouble periodontically. Correction will also aid mastication and prevent premature settling of the vertical height of the bite. From a mechanical and physiologic standpoint, this type of correction is highly desirable, especially as it is self-retaining.

SUMMARY

While the treatment of patients past the accepted age for orthodontia does not always present a favorable prognosis, there are certain cases wherein a great improvement is possible, provided the limitations imposed by age are well understood.

The cases should be carefully selected by the orthodontist, with the cooperation of the patient and the patient's dentist practically assured.

It is the duty of the orthodontist to render aid wherever there is a possible chance of a creditable result.

40 West North Street.

FURTHER STUDIES OF THE ETIOLOGY AND CONTROL OF DENTAL CARIES*

By PHILIP JAY, D.D.S., and ANN ESSER, D.H., Rochester, N. Y.

IN the previous publications, we have reported the close correlation between the incidence of *Bacillus acidophilus* in the human mouth and the occurrence of dental caries.[1] Aside from the persistent occurrence of this organism in dental caries, it was observed that mouths previously free of the disease became infected with *Bacillus acidophilus*

*Aided by a grant from the Rockefeller Foundation.

*From the Department of Bacteriology, School of Medicine and Dentistry, University of Rochester and the Rochester Dental Dispensary.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 8, 1929.

1. Jay, Philip, and Voorhees, R. S.: Bacillus Acidophilus and Dental Caries, Dent. Cosmos, 69:977 (Oct.) 1927. Jay, Philip: Bacillus Acidophilus and Dental Caries, J.A.D.A., 16:230 (Feb.) 1929.

at least three months prior to the clinical manifestation of dental lesions.

From time to time, there have appeared in the literature, statements to the effect that *Bacillus acidophilus* is a normal inhabitant of the mouth and that it can be isolated at will from any individual regardless of the presence or absence of dental caries. In the search for aciduric bacteria in the mouth, it is customary to employ mediums of acid reaction in order to eliminate the hosts of organisms present in the mouth which cannot survive an acid environment. It is generally agreed that while *Bacillus acidophilus* will tolerate an acidity of p_H 4 or 5 very well, it grows best in mediums adjusted to the neutral point. With this in mind, we took duplicate cultures in each case, employing both the acid and the neutral mediums. A sterile explorer was passed over the exposed surfaces of all of the teeth. The material so collected was shaken off into a small serologic tube containing 2 c.c. of sterile physiologic sodium chlorid solution. After a thorough shaking, equal amounts of the inoculated solution were transferred by means of sterile pipets, to tubes of glucose broth p_H 5 and p_H 7, respectively. After a forty-eight-hour incubation period at 37.5 C., the cultures were examined for *Bacillus acidophilus*.

In no instance, with this technic, did we fail to obtain the organism in the p_H 5 broth when the p_H 7 was positive. Conversely, in several instances, the p_H 7 cultures were negative though the corresponding p_H 5 cultures were positive. Apparently, in these cases, the aciduric bacteria were overwhelmed by the numerous organisms which were able to grow in the neutral broth. McIntosh, James and Lazarus-Barlow reported similar findings in 1922.[2] After repeated check-ups, we accepted the p_H 5 broth as our standard medium, and in our routine examination of caries-free subjects, we have been able to confirm our previous findings and those of Bunting,[3] namely that *B. acidophilus* is not necessarily an inhabitant of every mouth.

From the standpoint of preventive dentistry, it would be extremely interesting to observe the relationship of dental caries to the activity of *Bacillus acidophilus* in a large group of children and to determine whether or not the disease might be decreased in occurrence or extent by therapeutic control of the caries-forming bacteria. Such a study was conducted during the past year on children in the schools of Rochester, N. Y. The results form the basis of this paper. In the approach to this study, we reviewed carefully the previous work of Bunting and others, who reported results obtained in a similar study.[4] In this experiment, they used metaphen and hexylresorcinol as therapeutic agents, and they state that, by the use of these drugs, they eradicated the bacillus from the mouth in a large percentage of cases, and that a marked

2. McIntosh, J.; James, W. W., and Lazarus-Barlow, P.: An Investigation into the Etiology of Dental Caries, Brit. J. Exper. Path., 3:138 (June) 1922.

3. Bunting, R. W., and Palmerlee, Faith: Rôle of B. Acidophilus in Dental Caries, J.A.D.A., 12:381 (April) 1925.

4. Bunting, R. W.; Nickerson, Gail, and Hard, Dorothy G.: Further Studies of the Relation of Bacillus Acidophilus to Dental Caries, Dent. Cosmos, 68:931 (Oct.) 1926. Bunting, R. W.; Nickerson, Gail; Hard, Dorothy G., and Crowley, Mary: Further Studies of the Relation of Bacillus Acidophilus to Dental Caries, Dent. Cosmos, 70:1 (Jan.) 1928. Bunting, R. W.; Crowley, Mary; Hard, Dorothy G., and Keller, Margaret: Further Studies of the Relation of Bacillus Acidophilus to Dental Caries, Dent. Cosmos, 70:1002 (Oct.) 1928.

decrease, or a complete cessation of dental caries, was noted in the individuals so treated. For the purpose of checking these observations and of amplifying the data so far presented, the study carried on in the Rochester schools was conducted along somewhat similar lines, differing only in the fact that, in the latter instance, more frequent and rigorous treatments were given and more frequent bacteriologic examinations were made.

For the purpose of this study, it was not desirable to select a group of children who were confined to one particular environment, but rather to acquire a group representative of a typical community

TABLE I.—METAPHEN TREATMENTS
(JUNE, 1929)

Case	Treatments	B. Acidophilus	New Cavities
422	49	—	0
463	48	—	0
462	49	—	1
401	48	+	1
403	48	+	1
421	49	+	1
438	48	+	2
440	48	+	1
538	48	+	2

living under average conditions, and so we were obliged to depend on what material could be obtained in the public schools. Of the 300 children between 15 and 16 years of age originally selected, we were able to keep 222 under observation during the entire school year. During September and the early part of October, each child was carefully examined for dental caries and all cavities were charted on individual history cards. Cultures were taken from the teeth each week thereafter until the end of the school year in June. At that time, they were reexamined and new points of caries were recorded on the charts.

Those who yielded two consecutive positive cultures were considered, for the purpose of this experiment, susceptible to dental caries. From this group, some were arbitrarily selected for anti-*B. acidophilus* treatment, while the remainder were kept under observation as controls. This report will deal solely with the subjects under our observation during the entire period of the experiment, that is, sixty-nine treatment cases and forty controls. The remaining 113 were not dropped but were also kept under observation and cultured each week.

Nine of the susceptible group received a rigid course of the metaphen[5] treatment. The teeth were carefully polished and metaphen 1:500 was applied topically with the hard rubber cups and carried between the teeth with dental floss. The patient was then allowed to rinse the mouth thoroughly with metaphen 1:5,000. These treatments were given on three consecutive days every week. The nine cases received an average of forty-eight applications of metaphen during the course of treatment. (Table 1.) In no instance did the cultures become exclusively negative for *B. acidophilus* during this time though in three individuals the last four cultures were negative. In these cases, but one new point of caries was found and that was a small occlusal pit in a bicuspid. All of the remaining six who had continued to give a positive reaction for *B. acidophilus* had one or more new cavities at the end of the experiment.

Another group of sixty children used S. T. 37 hexylresorcinol in a 1:3 dilution as a mouth wash two or three times a day. (Table 2.) Only fourteen of the sixty, or 23.3 per cent, gave a negative

5. Footnote 4, first reference.

reaction for *B. acidophilus.* (June, 1929.)

Of the fourteen who developed a negative reaction for *B. acidophilus,* one developed a small occlusal cavity in a maxillary first molar, and, in another, we found a small suspicious occlusal pit in a bicuspid. Forty of the forty-six showing positive reactions had developed one or several cavities during the course of treatment. In the control group of forty, fifteen became negative with no treatment whatever and twenty-five remained positive. Dental caries occurred in eighteen of the twenty-five whose reaction remained positive and in two of the fifteen whose reaction became negative.

As can be seen in Table 3, the controls, as a group, fared better than those who received treatment.

The remaining 113 children under observation may be classified, according to the incidence of *Bacillus acidophilus,* into three groups (Table 4).

Further analysis of the records of the ten children in Group III who remained free of caries revealed that the positive cultures were widely scattered or else occurred late in the progress of the experiment. From our previous studies, we assume that if they continue positive, caries will occur.

SUMMARY

The fact that, in an examination of 222 cases, *Bacillus acidophilus* was recovered from all but six mouths showing dental caries further substantiates the concept that this organism is of primary importance in the etiology of dental caries. Furthermore, it was noted that, in both the treatment and control groups, in all those cases which became negative and remained so throughout the period of observation, there was an almost complete cessation of dental caries.

The findings relative to the effectiveness of the metaphen and hexylresorcinol as antagonists to *Bacillus acidophilus* do not agree with the published findings of Bunting and his associates. Of the cases who received anti-*B. acidophilus* treatment, only 24 per cent became negative; whereas, 37 per cent of the control cases became negative without treatment; and of the treated group, 69 per cent devel-

TABLE 2.—RESULTS IN GROUP USING S. T.-37 (HEXYLRESORCINOL)* (JUNE, 1929)

No. Cases	B. Acidophilus (—)	B. Acidophilus (+)	New Cavities
60	14	..	1 + (1 pit?)
		46	40

*Dilution: 1-3, mouth wash, two or three times daily.

TABLE 3.—COMPARISON OF TREATED AND UNTREATED CASES (JUNE, 1929)

	No.	B. Acidophilus+	B. Acidophilus—	
Treated Cases	69	52	17 (24.6%)	48 (69.5%)
Controls	40	25	15 (37.5%)	20 (50%)

TABLE 4.—INCIDENCE OF B. ACIDOPHILUS (JUNE, 1929)

Group	Number	B. Acidophilus	Caries since October
I	25	All cultures negative	5 (occlusal pits)
II	67	1 or 2 positive cultures, the rest negative	6
III	21	3 or more positive cultures	11

oped dental caries, while but 50 per cent of the control group had new cavities during the experiment.

We are free to confess that we do not understand the reasons for this discrepancy. We are fully aware that clinically marked improvement has been noted in individual cases after the inauguration of the metaphen and hexylresorcinol treatments; also that, in such a mass study, an infinite number of variables may enter which may materially alter the data obtained. For instance, the fact that a larger incidence of *B. acidophilus* and dental caries occurred in the treated groups than in the controls might be considered as evidence that the use of these drugs was actually favorable to the activity of these organisms and harmful to the individual. In view of the many variables which may have entered into this experiment, and in view of our observations of selected cases which were quite opposed to such a conclusion, we do not wish to place this interpretation on our data at the present time. In fact, we do not wish to draw any definite conclusion regarding the use of these drugs for the prevention of dental caries from this study alone. It is our opinion that further carefully controlled experiments should be conducted to determine the degree of efficacy of these and other drugs in the therapeutic control of dental caries.

DISCUSSION

Russell W. Bunting, Ann Arbor, Mich.: Dr. Jay has presented data which are the opposite of what we have seen and are seeing. I cannot account for it. How shall we interpret the fact that, in two groups of sixty treated cases and forty controls, the treated were worse off as far as caries was concerned than those that were not treated? I would call to your attention the fact that the therapeutic control of dental caries is by no means 100 per cent possible. It will only affect certain cases. I have two boys in my own family, one 16 and one 18. The younger boy can be made negative to *B. acidophilus* and kept so with little treatment. The elder boy, who has been given many treatments, has never given a negative culture. In the test tube in the laboratory, we can show that one organism will be killed by hexylresorcinol even in high dilutions, while another will not. The same thing is true of metaphen, and the two groups do not coincide. For that reason, we have recommended the use of both metaphen and hexylresorcinol, a sort of shotgun dose, to get as many of the organisms as possible. Many dentists have written in such profuse praise of what has happened in cases in their practices when metaphen and hexylresorcinol was used that I was led to believe that there might be some value in this treatment. We have perfectly open minds, and if these drugs are not valuable, we wish to know it. When we return to Ann Arbor, we will make a final check of about 500 children who have used hexylresorcinol twice daily over a period of one year. We have accurate records of each one of those cases, and we will compile the data and publish a statement as to just what happened. From what has gone before, I expect that we will find a direct benefit in about from 50 to 60 per cent of cases so treated. It might run a little higher because these children are also on a fair diet. As far as the data which Dr. Jay has presented are concerned, I am not able to visualize just what did happen in the group which he observed.

Weston A. Price, Cleveland, Ohio: What is the possibility that, in running these cultures over a period of nine months, we are really dealing with two phases in which another force is playing an important part? In about the fifteenth century, when the Black Plague was scourging England, it was discovered that when a cordon of people beating on tin pans were placed around a house, the people in that house did not get the Black Plague. They thought it had something to do with driving away evil spirits, but it had to do with the scaring away the rats that carried the infection. We are dealing here with an important but secondary incident in the development of dental caries. These studies of Dr. Jay's, if I understood him correctly, extended over nine months. If immunity and susceptibility to dental caries are influenced, as I believe they are, by vitamin factors which themselves have a rise and fall as an effect

of the changing seasonal conditions which I have shown to exist in dairy products, the fact that more or less cavities develop in one series of studies than another might primarily be an expression of the influence of the different vitamin levels at different periods. This does not mean that *B. acidophilus* is not an active factor in the production of calcification, but probably that it is related to the favorable or unfavorable conditions of the growth of this organism owing to changes in the culture medium provided by the patient. Several workers, particularly May Mellanby, Percy R. Howe and I, have presented evidence indicating the influence of vitamins on susceptibility to dental caries. Children grow (according to statistics) about three times as much between June and November as in the winter and spring period. My data indicate that dental caries is also much more prone to develop in the winter and spring months than in the summer and early autumn. The apparent lack of confirmation of the previous reports made by Dr. Bunting as found in the data presented today by Dr. Jay may readily be a record of the effect of another etiologic factor such as conditions in the vitamin levels available at different seasons. I think this is probable. We often get our most important information in research work from the thing we do not expect. I have come to be far more concerned and interested in the apparent contradictions than in the confirmations, and it is no reflection on the workers but rather a measure of the route by which progress has been made.

REPORT BY THE NATIONAL SOCIETY OF DENTURE PROSTHETISTS

WITH the desire to make available to the dental profession certain findings (verified through its efforts), the National Society of Denture Prosthetists submits this report.

The present brief summary of the conclusions of the society up to this time treats of: 1. The character of the most important movements of the mandible. 2. The mounting of edentulous casts on an articulator. 3. The requirements of dental articulators. 4. Cusp forms. 5. Mounting of casts for final balancing.

More detailed reports on these subjects as well as on other phases of the work will be submitted at some future time.

ANATOMIC FACTORS

The mandible is a solid body. The base of the skull, together with the glenoid fossae and the maxillae, constitutes another solid body. Any change of relation between the mandible and the skull must take place as a change between two solids. Since this is true, any motion in one part of the mandible necessitates a related motion in all other parts. The opening and closing of the mandible cannot be regarded entirely as a hinge movement, nor solely as a sliding movement.

The hinge motion of the condyles in the menisci is normally a pivotal motion about an axis passing through or near the condyle heads; the sliding motion consists of a forward movement of the condyles upon their articular surfaces. The hinge and sliding movements may be combined or may be executed independently.

The articular surfaces, upon which the condyles advance in the sliding movement, normally look downward, backward and outward. The size, form and inclination of these surfaces vary with different patients and frequently with the two glenoid fossae in an individual case.

The fibrocartilages which separate the heads of the condyles from the articular surfaces vary in thickness in individuals.

The portion of the cartilage which lies immediately between the heads of each condyle and the articular surface of the fossae is thin, and rarely, if ever, can be sufficiently compressed to alter materially the relations between the mandible and the maxillae.

FACTORS WHICH CONTROL THE MOVEMENTS OF THE MANDIBLE

The character of motion of the condyles is determined by the ligaments, by the muscles and by the forms of the articular surfaces; the character of motion of the anterior part of the mandible in edentulous cases is largely determined by the guidance of the replaced teeth, and is to that extent under the control of the dentist.

While many extreme positions of the mandible are possible, those most important for our purpose are the ones in which there is occlusal contact of the teeth within functional range.

The typical human chewing cycle is characterized by an opening movement of the mandible, a movement toward the side on which the chewing is done, a closing upon the food in this lateral position and a return toward the starting place. Many individual differences are discovered within this typical cycle, and these differences are most easily demonstrated on the balancing side. These individual differences of movement point to the necessity for corresponding individual arrangement of teeth.

THE MOUNTING OF EDENTULOUS CASTS

The use of the facebow is recommended. In those articulators in which the mechanical axis of opening is expected to correspond with the anatomic opening axis, the facebow is not only a convenience but also a practical necessity for mounting the maxillary cast; in those adjustable articulators having no mechanical opening axis, the facebow is not essential.

The mandibular cast is mounted on the articulator (at the desired degree of jaw separation) by means of an unstrained centric relation mouth record (bite).

The mandible is in centric relation when the heads of the condyles are in their most retruded positions from which the jaw can make free lateral movement.

The rest position is that position into which the mandible relaxes when not subjected to muscular control. This rest position should not be confused with the centric relation just described.

The use of the needlepoint tracing device for the purpose of determining and checking centric jaw relation is recommended as being both scientific and practical. The society recognizes no other means of verifying centric jaw relation.

REQUIREMENTS OF DENTAL ARTICULATORS

1. An articulator should be so adjustable as to cause the teeth to move on the articulator in such paths that they will function harmoniously in the mouth.
2. All guides should be independently adjustable.
3. The adjustments should be such that they may be used for purposes of study and record.
4. The adjustments of the articulator should permit "free play," thus avoiding the lock in centric occlusion of the teeth.

POSTERIOR TOOTH FORMS

Prominent cusps interlocking with opposing occlusal surfaces, in such manner as to interfere with the free lateral or protrusive movements of the mandible, cause dislodging forces to be exerted upon denture bases.

With our present conception of balanced occlusion, it seems that the reduction in cusp height is proportionally reflected in the decreased horizontal forces upon denture bases.

Broader occlusal surfaces require greater force to be exerted upon the supporting tissues. Artificial tooth forms should be comparatively small buccolingually in order to lessen relatively the amount of closing pressure necessary to be exerted upon the food.

Artificial teeth should be of such forms that they can be arranged to balanced occlusions.

MOUNTING OF CASTS FOR FINAL BALANCING

We recommend the use of casts which do not disintegrate nor change form during the curing process. Both casts and dentures should be removed intact, without separating the dentures from their casts, and the casts restored to their original seatings upon the mounting-plaster preserved on the articulator.

By this means, any errors introduced during the curing process may be detected and corrected on the articulator in accordance with the original articulator adjustments. This procedure, when followed in each case, obviates the necessity for making a new record of centric relation. With this accurate mounting of the dentures, a most important step has been taken to secure proper balance in centric and eccentric occlusions.

F. M. HIGHT,
C. J. STANSBERY,
VICTOR H. SEARS.

HAND INSTRUMENTATION IN OPERATIVE PROCEDURE*

By FINN J. BRONNER, D.D.S., New York City

SINCE our pliocene ancestors in England experimented with the first known hand tools, almost one million years have lapsed. Experience and intellectual development during hundreds of thousands of years were reflected in small successive changes in the patterns of these tools. A marked advantage usually brought conquest, migration and, thus quickly, standardization. They would have looked on our 2,000 dental hand-instrument patterns as made by one firm in 1914 with disdain as reckless tribal economy.

Whereas other professions today have standardized their mechanical equipment on the basis of computing speed, weight, dimension and density, the dentist has not availed himself of such data. The speed of his engine is undetermined. The heat evolved from his drilling is the only thing registered with an approximate degree of accuracy; namely, by the volume of his patient's voice. The dental engine was, soon after its introduction, found to be the x in the equation of efficiency, and its use was supplemented by a revival

*Read before the Section on Operative Dentistry Materia Medica and Therapeutics at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 10, 1929.

of hand instrumentation. But as even the thicknesses of the five principal operating areas of the teeth have not been measured, how, then, could blade length be determined? The problem of computing the width of the edge was complicated by an unknown quantity, finger force, which necessarily must overcome an unknown amount of resistance to scraping and chipping.

Dr. Black selected 102 instruments on an empiric basis, but advised that a lesser number might suffice. Now, every school boasts of a different set, and some encourage individuality to the extent of permitting individual preference among students and instructors.

In order to stop this waste in our national household, it is imperative to remove forty-eight state barriers by placing instrumentology and instrumentation upon an unshakeable basis. I have therefore attempted to analyze, measure and compute every conceivable factor involved in selecting instrument patterns and manipulating them to their maximum efficiency.

The first problem which presented itself for investigation was to what extent variations in technic and equipment

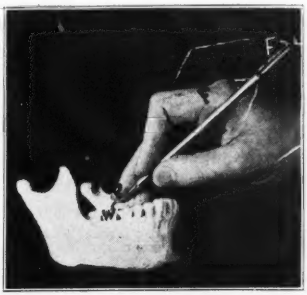

Fig. 1.—White lines indicating outline of the longer hand showing fulcrum (*F*) in the same plane as that for the shorter hand; hence, inclination is not affected by finger length.

Fig. 2.—Lever of the third class. *W*, working point; *P*, power; *F*, fulcrum. This illustration shows the common error of applying the finger (power) too far from the working point (*W*), thereby increasing the load arm (*W-P*) at the expense of the power arm (*F-P*).

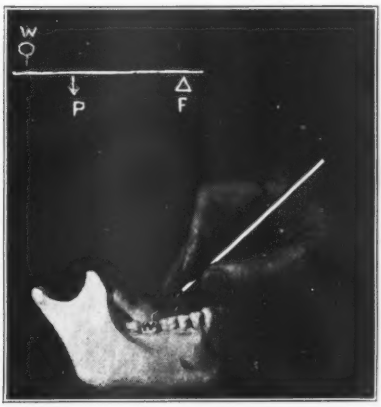

Fig. 3.—Using the longest finger as power close to the working-point to attain the maximum mechanical advantage. The index finger is now free to oppose the short thumb in an efficient grasp.

are warranted on the grounds of difference in finger size. A great number of measurements of the middle and ring fingers showed that they raised the instrument shaft respectively 10 mm. and 23 mm. at the point of contact.

Although the fingers, to all appearances, vary in thickness, the difference involved chiefly the soft structure, which was compressed, while in a working position, to a point remarkably near the average for thin fingers. The latter were naturally compressed much less. Extreme variations were 2 mm., the effect of which on the instrument inclination (or angle) was negligible. Long fingers bring the fulcrum farther from the point of application of force, and this is of some advantage, but they do not influence angulation because the fulcrums lie in the same plane. (Fig. 1.)

Before I illustrate how the short-handed operator can remedy his slight handicap, I shall first point out a common error whereby every hand or finger type loses in efficiency and power. (Fig. 2.)

You will observe that the working point *(W)* of the lever is represented by the edge of the instrument, the fulcrum *(F)* by the crotch between thumb and index finger, while the first finger represents the power; in other words, a lever of the third class. As the operator's power increases with increasing length of *FP,* the index finger in this picture obviously lies too near the fulcrum, besides limiting his pulling range. The object, then, is to apply the force as nearly as is convenient to the working point. The finger closest to it is the logical source of power. (Fig. 3.)

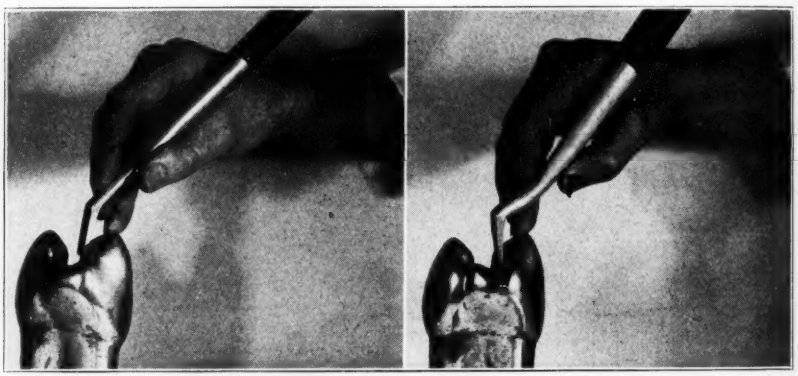

Fig. 4.—Left: Incorrect hoe design. Right: Correct hoe design showing "seat" for the application of power. The working point of a third class lever should be in a plane through the finger tip parallel to the long axis of the shaft. (A first class lever should have the working point on the opposite side from that of a third class lever.)

This finger grasp might feel clumsy at first; but it leaves the index finger free for its primary function of opposing the thumb in an efficient grasp. The third finger is used as a rest and should never lose contact with the second. This compensates for the loss of leverage when hands and fingers are short.

The indisputable fact that the power should be applied near the working point makes it desirable to furnish all angled instruments with a seat or plane at right angles to the blade for the finger exerting the power.

Figure 4 shows the existing incorrect design and my corrected hoe design, with the seat.

Incidentally, this brings the edge near a plane through the finger tip applying the power parallel to the long axis of the instrument shaft, and prevents its turning in the hand when power is applied.

There are more pitfalls however. Figure 5 shows almost the same finger posi-

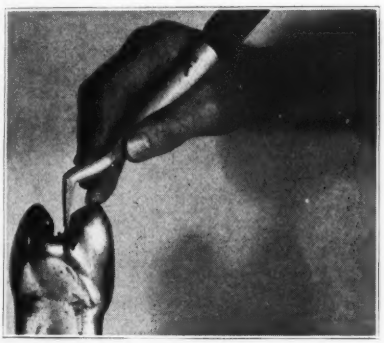

Fig. 5.—Power correctly applied, but power arm shortened by turning the thumb under the instrument.

tion, but the thumb has been rotated under the instrument, thus acting as a fulcrum and bringing this too close to the power.

This type of lever, the third class, is employed in cutting and chipping, and in most scraping operations.

Fulcrums are usually not available for the more powerful lever of the first class (Fig. 6) except for interproximal scraping and chipping and upstroke scraping. (Figs. 7 and 8.)

I feel certain that the sliced proximal preparation without box form is largely the result of the difficulty experienced in producing buccal and lingual walls facing each other. The instruments that I have devised for this purpose (Figs. 7 and 8), being levers of the first class, are naturally more efficient than in downward cutting with enamel hatchets (which are levers of the third class).

You will observe that the second finger is, as a safety measure, interposed between the instrument and the tooth. In order to gain power, now represented by the index finger, this is moved back from the fulcrum. In this manner, one can always with ease scrape a box formed resistance-form in the hardest dentin.

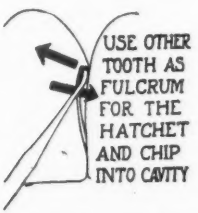

Fig. 6.—First class lever, more easily controlled but having a limited use because fulcrums are not always available. It can be used on the gingival in Class 3 to chip undermined enamel.

For the purpose of testing the power necessary for these operations, I constructed two machines which accurately register and record pressure. (Figs. 9-11.)

The results so far have emphasized the importance of correct application of force and angles, but I am withholding exact data pending further experimentation. Both machines are innovations in principle which obviate the necessity of exact centering. One machine completely eliminates lever-action and friction.

I am about to make monthly records on it of improvements in the students' finger power and even working qualities. The machine is also proving its usefulness in recording the chipping resistance of the enamel and the packing pressure for amalgam, and as a guide to gold condensation.

By far safer and less painful than the employment of stones and burs is the scraping of the dentin with a sharp blade. For this purpose, its optimum position is vertical. Of other determinants of instrument angulation, I have already alluded to the finger rests causing the instrument shaft to be raised.

These conditions and others influencing the correct choice of angles were next in line for investigation.

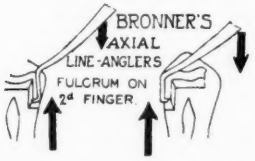

Fig. 7.—Diagram from author's instrumentation chart showing an instrument, a first class lever, designed for the scraping of proximal box forms. The instrument automatically produces opposing buccal and lingual walls. Anatomic nomenclature is used here and in Fig. 14 (second finger-middle finger).

Having refuted the short and long hand influence, I constructed, for the sake of observation, an angle-registration apparatus around a set of teeth, five diameter scale (Figs. 12 and 13), to which all subsequent measurements were transferred.

In order to establish the absolute physical limit to shaft elevations, a great number of adult mouth openings, strained to the limit, were measured at the mesiobuccal angles of the first bicuspids. The average was found to be 48 mm., the smallest 35. (Fig. 14.)

From these points, the shaft inclination to 2 mm. above the center of the occlusal surface, and perpendicular to the pulpal wall, registered respectively 11.1 and 13.8 degrees. I concluded that the smallest angle which can be used in this uncomfortable position is 13.8 degrees, requiring three or four fingers piled up to secure rest. The smallest angle which can be used with comfort by the operator is 17 degrees figured with rest on both the middle and the ring finger. The three molars could be most

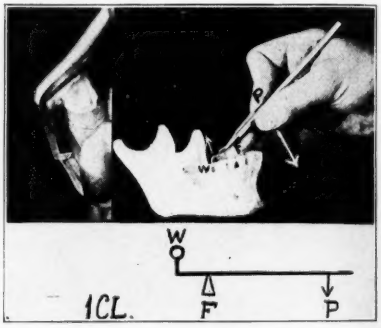

Fig. 8.—Illustration showing that the finger representing the power should also in first class levers be applied as far as possible from the fulcrum. Consequently *P* should not be retracted.

efficiently operated on with an average angle of 15 degrees.

Similar calculations from fixed points were made for the buccal surfaces to test the shaft elevations relative to Class 5 cavities.

The bicuspids and the anterior teeth come under another category owing to the possibility of greater adjustment of the shaft elevation.

In order to enable you quickly to recognize the correct angle for any cavity

variation in the mouth, I have formulated three fundamental rules. (Fig. 15.)

Rule 1: If the instrument shaft in pen-grasp position is practically perpendicular to the wall operated on, use an angle of 6 degrees (by moving finger rest or lowering shaft). This I have termed first relation.

Rule 2: If the instrument shaft is neither perpendicular nor parallel to the wall to be operated on, an angle of 15 degrees should be used. This I have termed the intermediate or second relation.

Rule 3: If the instrument shaft is parallel to or lies in the same plane as the wall operated on, use an angle of 23 degrees. This I have called third relation.

The three relations are shown on my angle-registration apparatus. (Figs. 16-18.)

Research methods require that the correctness of the rules be proved by their application. It will be noticed that first relation calls for an angle of 6 degrees, although the instrument shaft in pen-grasp position can be held perpendicular to the wall, when at first glance a straight instrument seems indicated. An angle is chosen for the same reason that a laborer in relation 1 to the ground steps back from the spot on which he stands in order to obtain unobscured view and better leverage for his pick or spade.

In this light, let us analyze an instrument from a well-known set. The formula is 12 (80) 5-6 devised for gingival walls in anterior teeth. The last figure, 6 degrees, indicates first relation with an opportunity to "step back."

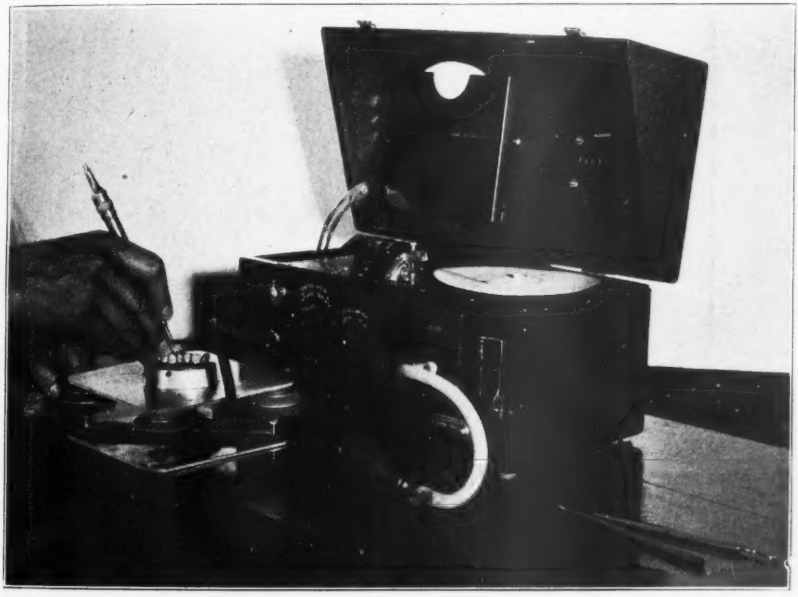

Fig. 9.—Author's manodynamometer with revolving recording disk (subsequently changed to roll type). Lever action and friction have been eliminated.

But as neither finger nor instrument lie in the plane of sight, the view is unobscured. An angle is, for this reason, unnecessary. (Fig. 19.)

Furthermore, as the gingival wall in class 3 is facing the incisal angle and there is no other finger rest *obtainable* (by "stepping back") labially or lingually, any angle of the blade is obviously wrong. In fact, in the labiolingual stroke, the shaft must, for no good purpose, point 6 degrees into the oral cavity, which is very inconvenient. (Figs. 20 and 21.)

The bayonet-shape overcomes the obstacle formed by the incisal corner of the tooth, and the removal of the angle of the blade makes it possible to convert the instrument from a lever of the third class to the convenient lever of the first class. (Fig. 22.)

The blade is too long for our cut-and-scrape technic and too wide for use in the smaller anterior teeth.

An altogether different aspect is presented by the compensating angle of the edge (85 degrees). The presence of the incisal corner of the tooth necessitates a 5 or 6 degree tilt of the instrument shaft in order to produce a horizontal floor. As the edge of an ordinary hoe would coincide with 75 degrees, an edge of 85 degrees must necessarily produce a gingival wall inclined toward the axial. (Fig. 23.)

This is not a mistake, but it should be borne in mind that it is the equivalent of an undercut which I have shown in another analysis to be consistent with good engineering principles.

Fig. 10.—Author's manodynamometer; showing how the problem of exact centering was overcome. The four inflated drums are connected by tubes insuring pressure equilibrium.

Fig. 11. — Gnathodynamometer employing principle illustrated in Figure 10.

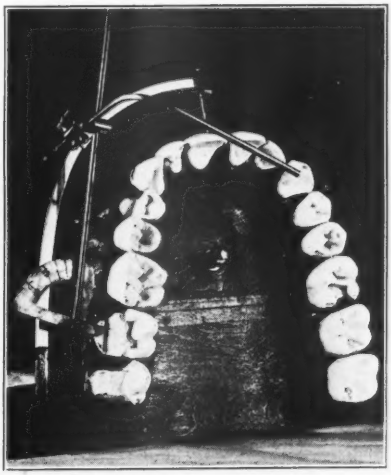

Fig. 13.—Occlusal view of apparatus in Figure 12; showing movable slide for the hoe at adjustable and recordable distance from teeth.

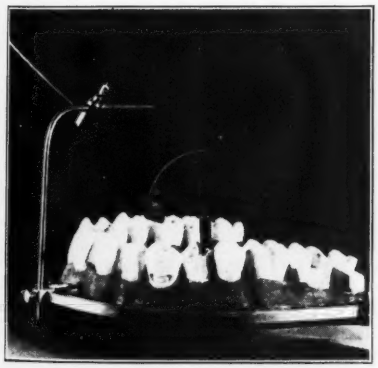

Fig. 12.—Buccal view of author's angle determination apparatus (5 diameter scale) showing hoe with sentigradation. Upright support for shaft is millimeter graded. All measurements were transferred to the apparatus and the angulation was recorded.

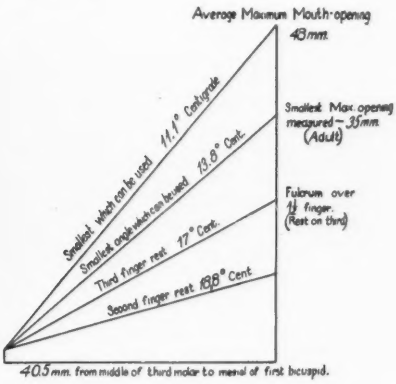
Average Maximum Mouth-opening
48mm.
Smallest Max. opening measured – 35mm. (Adult)
Fulcrum over 1st finger. (Rest on third)
Smallest which can be used 11.1° Centigrade
Smallest angle which can be used 13.8° Cent.
Third finger rest 17° Cent.
Second finger rest 19.8° Cent.
40.5mm. from middle of third molar to mesial of first bicuspid.

Fig. 14.—Chart showing anatomic nomenclature: thumb, first, second, third and fourth fingers have been used here. The second finger in diagram is actually the third.

This test proves the soundness of Rule 1; removes one pair of incorrect instruments from our set, and supports the correctness of my gingival hoes with the formula 10 (85) 4-0.

A further improvement consists of two pairs of gingival hoes with a bevel on opposite sides; which makes it possible to

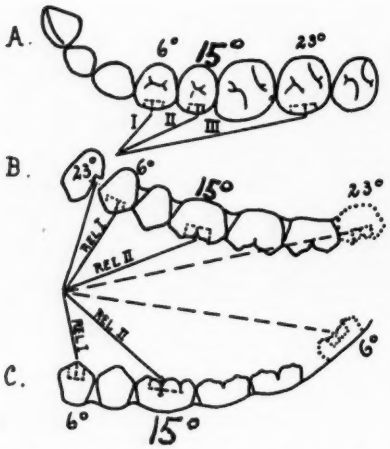

Fig. 15.—Application of author's three rules for the choice of angles. Dotted lines show that the curve of Spee influences instrument angulation differently in the upper and lower molar region. A "drifted" second or third mandibular molar will often be in first relation.

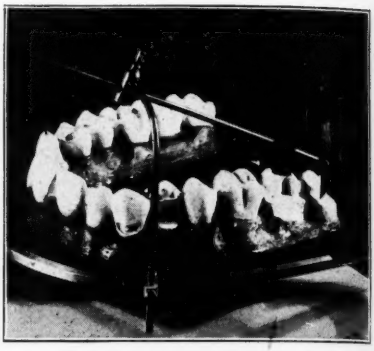

Fig. 17.—Second relation. An angle of 15 degrees centigrade is required.

as levers but also as millimeter gages with three edges. The formula name will enable you at all times to determine the depth and width of a cavity. The sides of the blades should be furnished with acute bevels for scraping and should be routinely honed.

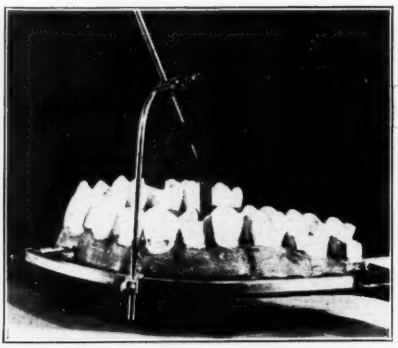

Fig. 16.—First relation. An angle of 6 degrees centigrade is required.

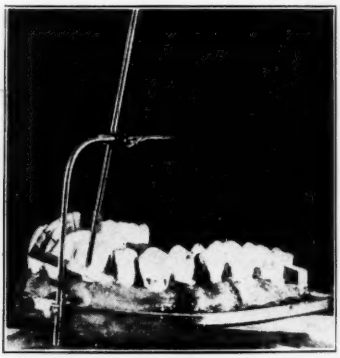

Fig. 18.—Third relation. An angle of 23 degrees centigrade is required.

complete the entire operation through either the labial or the lingual embrasures.

CONCLUSION

May I impress on you the importance of considering hand instruments not only

A selection of blade sizes based on measurements of structures and walls for which they are used is by itself a long chapter. It is one of the many problems which has received careful consideration.

Fig. 19.—"Stepping back" in order to obtain an unobscured view is here unnecessary as the line of vision is at right angles with the shaft. No angle is required for this reason.

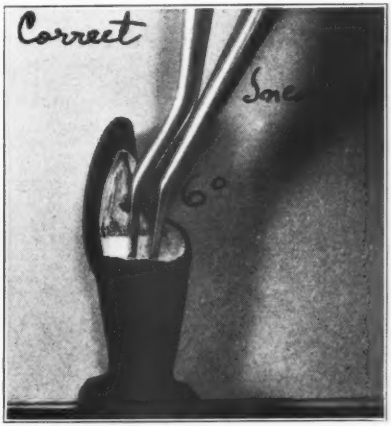

Fig. 21.—Correct and incorrect design.

Fig. 20.—An instrument with the formula 12-(85)-5-6 must point 6 degrees centigrade into the oral cavity. Finger rest is not obtainable lingually or labially.

Fig. 22.—Correct design (10(85)-4-0) applied as a lever of the first class.

Changes in ratio length to width have been based on the measurement of teeth and tooth walls, resulting in simpler instrument formula without the previously existing exceptions. (Fig. 24.)

Black's enamel hatchets are made on the principal of one large and one small hole in the same door for the accommodation of a large cat and its kitten. Only in this case, the longer blade of the molar instrument should have been constructed for the bicuspids, which have taller crowns than the molars. This absurdity

has been remedied by eliminating two superfluous instruments and by reducing the width of the blade (0.3 mm.). This means an increase in width of 0.2 mm. of the smaller blade, which has been too narrow to be handled with safety.

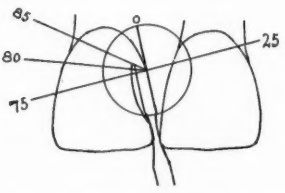

Fig. 23. — Diagram illustrating that an edge of 85 degrees centigrade produces one of the few desirable undercuts in cavity preparation. (Bronner: Engineering Principles Applied to Class II, J. Dent. Research, March, 1930.)

Similarly, the 2 mm. longer blades of the gingival margin trimmers subsequently used on the same walls as the enamel hatchets have all been made the same length.

Could you 70,000 designers but realize the cost of aimless experimentation for which we all have to pay—could you but visualize the confusion it causes in teaching—scientific instruments would automatically replace college brands.

The technic has been used by New York University College of Dentistry for two years, in which time it has been possible to demonstrate 100 per cent increase in speed, with higher standards. Other colleges have so recently adopted it that a report cannot yet be expected.

For teaching purposes, the chart has been made to fit students' instrument cases and it is large enough to be read by the operating dentist at a distance of 6 feet.

The first column shows the instrument selected for each class of cavities. This is of practical value to the student and the office assistant who selects, sterilizes and arranges the instruments according to the class indicated in the appointment book.

The next columns give, under the headings outline, decay, resistance, retention, convenience and cavosurface, bevel stepwise instructions mostly in arrow

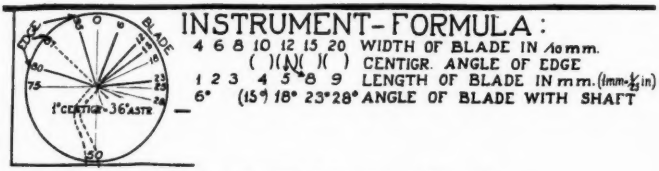
INSTRUMENT-FORMULA:
4 6 8 10 12 15 20 WIDTH OF BLADE IN 4o mm.
( )( )( )( ) CENTIGR. ANGLE OF EDGE
1 2 3 4 5 6 8 9 LENGTH OF BLADE IN mm. (1mm=1/40 in)
6° (15°) 18° 23° 28° ANGLE OF BLADE WITH SHAFT
EDGE
BLADE
85
80
75
1° CENTIGR. = 36' ASTR
150

Fig. 24.—Simplified instrument formula.

form, indicating direction of stroke, while average wall-dimensions compiled from hundreds of tooth sections appear underneath each class.

Some of the facts submitted contradict common belief, such as the disappearance of the pulp-horns of the molars. Although the distal cornua recede early, the mesial ones persist (also the buccal in the bicuspids), as a rule, not as an exception. The buccolingual distance between them is remarkably constant in the upper bicuspids and all the molars. This fact is our guide in determining the width and the depth of an occlusal cavity.

A new interpretation of class 2 cavities (published in 1927) is the chief departure from unsupported doctrines

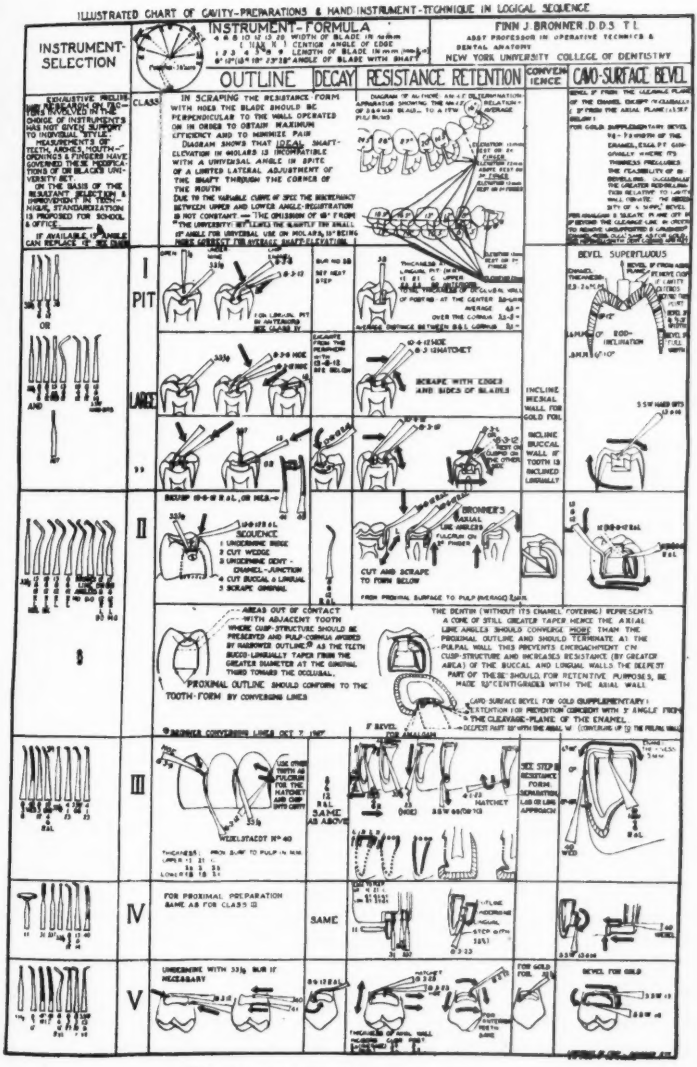

Fig. 25.—Author's instrument chart.

which has been dealt with in the chart. An equally prominent place is occupied by diagrams and rules pertaining to the cavosurface bevel.

For the latter operation, a microscopic check-up (in collaboration with W. H. O. McGehee) proved Drs. Gillett's and Irwing's findings; namely, that smooth

bevels can be produced by chisels. But this applies only to straight lines or long curves. For acute curves, in class 1 and class 5 cavities, we proved the soundness of employing smooth fissure burs. This discrimination I had already set forth in my chart based on my observation that the blades of the bur are only a succession of hoes traveling in acute curves.

DISCUSSION

Robert E. Blackwell, Chicago, Ill.: This is one of the most important phases of operative dentistry. But the average dentist appears to be wofully lacking in knowledge of good instrument forms and in the technic for accomplishing definite things in a skilful way with a few carefully selected instruments. The gold inlay has brought about numerous changes in operative dentistry, many of which have been of great benefit to the profession and to the public; but with the general use of the gold inlay has come the general use of stones in cavity preparation, and accompanying this change, the gradual decline in the use of hand excavators. Scientific procedure has given way to the brute force of stone grinding, with the result that many cavities are not so definitely cut as they should be and the continuous grinding results in an unnecessary amount of pulp irritation. In the use of the pen-grasp, the bulbs of the first and second fingers and the bulb of the thumb should grasp the instrument. This gives much power and a considerable range of movement and leaves the third and fourth fingers free for a rest on the teeth. In Figures 4 and 5, I would consider the finger grasp as being incorrect regardless of the design of the instrument. Again, in the use of the chisel in scraping the gingival wall of a class 3 cavity, an attempt has been made to correct an error (Fig. 20) by the use of a bayonet instrument (Fig. 22). In this case, while the application of physical principles is correct, the practicability of this use of the instrument is still in doubt. The length and width of blades of enamel hatchets have come in for criticism by Dr. Bronner. In the preparation of the proximal portion of a class 2 cavity, the enamel hatchet is used, among other things, to scrape the gingival wall and to plane the buccal and lingual enamel walls and bevel the cavosurface angle. In scraping the gingival wall, one requires an instrument with a blade sufficiently long easily to reach the wall. In spite of the anatomic differences in the length of the crowns of bicuspids and molars, the bicuspids being the longer, it is a fact in my experience that longer blades are required for molar teeth than bicuspid teeth because the cavities in the molars frequently extend farther rootwise than do similar cavities in bicuspids. The width of the blade, of course, should not be so great as to have its action interfered with by the proximating tooth. But in planing the buccal and lingual enamel walls, a wide blade is advantageous because it is more easily controlled. For these reasons, it may be a decided advantage not only to have four enamel hatchets for use on the bicuspids and molars, but also to use all of them in the preparation of a single cavity. In considering the relation of the instrument to the plane of the cavity wall to be scraped, Dr. Bronner shows the second and third relation employed when working on occlusal cavities in the molar teeth. It should be borne in mind that many times our access to an occlusal or a proximoclusal cavity is from the side rather than from the front of the mouth, so that with the mouth well opened and the cheek pulled back, the more effective first relation can be employed. In the upper arch, the palm and thumb grasp can frequently be used, the instrument being in first relation. This grasp is very powerful and sure and should be cultivated and used whenever practicable.

Dr. Bronner (closing): Dr. Blackwell has apparently misunderstood Figures 4 and 5, which purport to show only seat and leverage. The huge models of the tooth and the instrument compared to the small hands obviously preclude a demonstration of proper finger-rests, one of which is described by Dr. Blackwell. He questions the practicability of scraping the gingival wall. Hundreds of operators can testify that such procedure is past the experimental stage. I have frequently demonstrated that any one can prepare it much more quickly with hand instruments than with revolving burs. Besides, line and point angles cannot be produced by a revolving method. Dr. Blackwell mentioned the frequent occurrence of subgingival decay in molars. This does not coincide with my personal observation nor with any pub-

lished data. Yet, for those very few exceptions, I can see no logical reason for employing a longer blade in the shorter molar and a shorter one in the longer bicuspid. Dr. Blackwell also mentioned something of which I am aware; namely, that, in certain cases, you can place yourself in relation 1 where relation 2 is indicated in my diagram. (Fig. 15.) I explained this in a paper read before the International Association for Dental Research in Chicago. When Dr. Blackwell finds this particularly applicable to the upper posteriors, I beg to differ with him. It is evident that he overlooks the curve of Spee which, in the lower jaw, consists chiefly in an increasing forward inclination of the occlusal surfaces of the molars. In a steep curve of Spee or when a molar has tilted forward in closing up space created by extraction, the operator will be placed in the position where the shaft of the instrument is practically perpendicular to the wall to be operated on. In the same diagram, the reverse condition in the upper molar region has already been indicated and tends to place the operator in the third relation rather than the first, as contended by Dr. Blackwell. A discussion of the palm and thumb-grasp is beside the question as it is powerful enough to offer no difficulty where indicated. It concededly cannot replace the pen-grasp and its two modifications mentioned in my paper; i. e., rest on the third finger, fourth finger with the index finger as power, and rest on the fourth finger with the third finger as power.

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Editorials

MAKING MONEY

Of all the interests that dominate men today that of making money seems to be the most impelling. That is the one god that is most universally worshipped, and it need not be claimed any longer that money-worship is confined to Americans. It has grown to be quite the fashion to charge Americans with being money mad, as if all other peoples were above this propensity; while, as a matter of fact, it is a world madness, if indeed there is any madness about it. Travelers in Europe, in Asia, in Africa, in the Orient—every place—will tell you that the inhabitants of those countries are not averse to seizing on every pretext that will put money in their pockets. It seems to be a dominant tendency the wide world over, and no one nation should be charged with the outstanding predilection for keeping the eyes constantly on the main chance. All nations do it.

Another thing: whenever a nation or a person is charged with money mania, there is always an implied reflection, as if it were

in the highest degree reprehensible. Of course, to be a miser pure and simple, to try to accumulate money dishonestly or at the expense of the unfortunate, is entirely beyond the pale of respectability, and indefensible, but surely a man or a nation may accumulate wealth without necessarily meriting the opprobrium of being considered dishonorable. A worse crime than making money is hoarding it and keeping it out of circulation, and assuredly Americans can never be charged with this. If they sometimes seem to concentrate on accumulating money, they spend it with the same lavish abandon that they acquire it. There is little real meanness associated with moneyed Americans.

But to go back to the consideration of the present dominant tendency for making money: there is a very good reason for it, and it is by no means an unworthy reason. There never was a time in the history of the world when money was so useful and so important as it is today, when it would procure so many things to contribute to the comfort and welfare of the people. If it is the manifest destiny of mankind to get happiness out of life—and surely it is—then everything that contributes to this happiness is good and is laudable. The multiplicity of comfort-giving commodities today creates a new use for money, a very praiseworthy use. We hear much about the "good old times," and the so-called "simple life." Who would elect to go back to them? It may be a lark to go camping in the summer and live in a tent and try to read by the light of a log fire or a tallow dip, but basically that is all it is—a lark. Condemn any proportion of sensible people today to the primitive life of log houses and lack of sociability, to the ox team or the foot trail through a miry swamp, to the precarious livelihood of some of the pioneers and see how much happiness it would bring to them.

In the good old times, there was little incentive to make money because there were so few things that money would buy. The world has gone ahead by leaps and bounds, and the creature comforts of life have increased at an amazing pace.

The joy of making money is never found in hoarding it; the real incentive is for the acquisition of the things that money will pur-

chase, and as long as the things that are bought with money go to make the lives of people more comfortable and comprehensive, as long as they broaden the vision and add to the fullness of life, it is in every way commendable to make money and to spend it, for the happiness of others. Think of the days when electric light could not be bought with money, because there was no electric light to buy. Myriad things of beauty and utility are made today that were never dreamed of in the days of our forefathers, and as new things are devised for the benefit of humanity, the demand for money naturally increases. And it is right and just that as new things are invented for the enjoyment of the people, the people should have access to them.

Why content ourselves with living a stunted, incomplete life? Let us make money, all of it that we legitimately can, and let us spend it for the improvement and the happiness of the people. When the spending of a little money, or a lot of money, can bring a smile to the wan faces of poverty stricken or suffering humanity, when it can brighten the prospects of those in despair, when it can give new courage and new ambition, when it can open the gateway to opportunity, when it can stimulate to the achievement of better things in life, and lead to greater self-respect and nobler effort—when money is capable of doing all of this as it has done in the past, then shall we not decry money as is so frequently the habit, but let us respect it and be thankful for it.

The only stipulation is that when money is made, it shall not be used for the oppression or exploitation of the people, but for the expansion of benevolence and the admission of sunlight and hope and charity into despairing human hearts. And money cannot be used for these laudable purposes unless it it first made. Let us make more and yet more money.

THE DENVER MEETING

The time seems so short since the annual meeting at Washington that it hardly appears possible that another is so near at hand. This

year, the time for preparation is shorter than usual. From October to July seems a brief period in which to get ready for a great meeting, but from present indications, the various committees and section officers have apparently gone at their task in a most praiseworthy manner, and the outlook is excellent for a good meeting. From the very beginning, the Local Committee went to work with energy and vision, and the various divisions under their direction seem to be well organized and in good working order. It is always more or less of a task for a local committee to "hit its stride" in a job that is for the most part new to it, but let it be said to the credit of our various committees in the past that they have almost uniformly given the Association excellent service and aquitted themselves with distinction.

The program of the sections this year seems to be most promising, and the prospect is excellent for a very interesting scientific presentation of the latest and best in dentistry. The location of Denver should lend itself to a very large attendance, and it should also bring out a representative gathering from certain sections of the country which for the past few meetings have not sent very many members. It is an excellent idea and in every way equitable to vary the meeting place to encourage the different sections of the country, and Denver should attract a large attendance from certain regions that could not conveniently send many representatives to Washington.

We are informed that hotel facilities are in every way adequate for the comfortable housing of all those in attendance, and the climate at this time of the year should be perfect. Every loyal member of the Association should begin making plans at once to attend this meeting, which promises in many respects to be an outstanding event.

WHAT IS ITS RATING?

The recent stock market crash has brought home to a great many the necessity for wise counsel and advice before investing. Many "sheep" now realize, altogether too sadly, that specialized fields

of activity require special technical advice and knowledge. This feeling has no doubt given rise to the popularity of many investment advice organizations. These agencies are a natural development, aiming to supply the technical information which the conservative investor needs, but is otherwise unable to get. When John Doe contemplates investing surplus income in the Blank and Blank Company, he requests the financial advisory agency for a report of the concern; its stability, past earning records, future dividend prospects, etc. These facts are so elemental as to appear trite.

The complexity of modern dentistry, especially in the therapeutic field, has made it a physical impossibility for dentists to know the scientific status of many pharmaceutic products put out under proprietary or brand names, not to mention the flood of dental nostrums exploited to the public. It was a recognition of this fact that brought about the creation of the American Dental Association Bureau of Chemistry and, more recently, the Council on Dental Therapeutics. The members of the Council, all experts in their special fields, are ready to serve without remuneration and to report without fear or favor on proprietary drugs sold to the profession. It places at the disposal of dentists unbiased information, free alike from prejudice or prepossession.

As the investment advice agency reports on the security and dividend prospects of a stock issue, so the Council on Dental Therapeutics will report on what might be called the scientific probity of proprietary and unofficial pharmaceutic products of dental interest.

The investment "advice" agency, for a substantial "subscription price," will furnish reports on stock and bond issues; the Council on Dental Therapeutics will, without any expense to the profession, furnish reports on proprietary products sold for the cure and relief of dental ailments.

The careful investor avails himself of the services of an "investment advice agency": there are financial interests at stake. The conscientious dentist will avail himself of the services of the Council; the dental health of the community may be at stake.

BUREAU OF DENTAL HEALTH EDUCATION

MANAGEMENT OF THE JUVENILE PATIENT, AND TREATMENT OF THE PULPLESS DECIDUOUS TOOTH*

By W. C. McBRIDE, D.D.S., Detroit, Mich.

INITIALLY, may I say a word in my own defense, in defense of those who practice pedodontia. It is common opinion, even among dentists, that one who practices dentistry for children must necessarily spend about two thirds of his time in idle play with the child as a necessary adjunct to the establishment of friendship. Some assume that we play games with them and narrate a long list of fairy tales or funny stories that we may become sufficiently acquainted and congenial, and then, at a given time, when we feel the acquaintance and congeniality are satisfactorily established, the child will walk right in and accept the discomfort of an extraction without a murmur. I smile sadly at the impression some have of my vocation. I am amused at times with the attitude of some men who, in their practices, make elaborate restorations for adults and calmly intimate that they cannot be bothered with children. I have heard the same individuals discuss the value of prevention in dentistry, frequent examination and prophylaxes, elaborating here and there on sanitary appliances, etc., forgetting all the while that if one practices true prevention in dentistry, he must necessarily begin with the child.

Pedodontists, like other dentists, have learned the relative value of time. Necessity has given all of us a firm understanding of operating costs and overhead. Nowadays, every line of endeavor must be thoroughly systematized, with due consideration for detail and convenience and routine.

In my office, when the child comes for his appointment, the name is brought in and left on my desk. When the child enters, I have all the data at hand and greet him or her, first with a "Hello, John" or "Hello, Patricia," as if I really meant it—not in a mechanical tone. The parent is of secondary concern. If you must have a phonographic salutation, reserve that for the parent. The average child of from 3 to 8 years, for instance, does not know that you know his name, nor does he realize how you learned it, but the important thing is that the minute he is so called half the fear is gone and he warms up to you at once. Children come in occasionally shy and fearful, shuffling along sideways while clinging to the parent, but respond immediately

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

when greeted by their name. They seem to feel a certain security when among friends. Children have vanity just as does the adult, and many feel belittled and resent in their own way such salutations as "Hello there, sonny" and "Hello, dearie." "Dear" and "dearie" as a form of address should unquestionably be reserved for the family alone. At least, it should not be used by public servants. It is not too great a task to call a child by name.

The major portion, and in many cases all of the conversation, should be directed to the child. Barring an initial casual remark, the comment should regard the patient or the particular thing that we are doing. I make the appointment a business proposition. While I am making myself ready, the assistant seats the patient and makes him ready. I begin at once. Lost time is expensive; wasted time is inexcusable. Too much idle talk with the child makes him familiar, and this, in turn, breeds a type of conduct that impairs discipline and hinders accomplishment. Do not gather from these remarks that my procedure is of the "hammer and tongs" type. I believe and practice kindness and consideration and I have all the patience required, but I have learned that to be a good disciplinarian, to be successful with children, one must be methodical and reserved.

Appointments are kept promptly. If you keep a child waiting, you must expect a restless patient.

With a new patient, a great deal of explanation is required at the initial sitting. I explain briefly as I go along the use of the mirror, explorers, excavators, burs, etc. The finest way that I know to demonstrate the use of the bur is to apply a cross-cut fissure bur to the thumbnail of the child while it is in motion. The young patient sees filings come off the nail with no infliction of pain and his fear wanes. He is told then that it does the same to the tooth, cutting away the decay, only that it makes more noise and gets warm occasionally when it is left on too long, etc. With children of from 3 to 5 years, the first appointment is short and, barring an occasional extraction to relieve an aching condition, very little is done. I either seal in a sedative in an aching vital tooth or prepare and fill some one small cavity. A sedative treatment in an aching tooth serves a dual purpose—relieving the ache and subsequent pain of cavity preparation and also acquainting the child with dental procedures. I try to do nothing for the child at the initial sitting, barring an occasional much needed extraction as mentioned above, that will entail any discomfort. As first impressions go a long way with children, I make this a cardinal point in my practice.

At the second appointment, the "ice is broken," and operative work can be begun in earnest. I coach the patient along when using the bur by telling him it will hurt here, and it will not hurt here, etc. When he learns that you know where the hurt is, when he learns that you are truthful and dependable, he does splendidly when the hurt period does come. Incidentally, this procedure works well with an adult patient as well. But let a bur "sail along" through a tooth at top speed, hurting here and there as it will, without any explanation or comment, and see what happens. The patient becomes frightened, fretful and tense during the whole operation. The painful part of any cavity preparation, the cutting of the "step," should be delayed until the last. Do all the excavating that will not entail any discomfort before approaching the sensitive area. A few moments of pain at the end of the grinding will be borne

more graciously than at the beginning.

It is difficult to present any fixed procedure for different types of individuals. With experience and association, one becomes able to judge quite accurately when the patient enters the operating room for the first time. A timid, frightened child requires a great show of kindness and explanation. He must be shown the instruments and be told their uses. He must be taught, in the short initial sitting, that it is not all hurt and that everything is done for his interest. A child who is shy and noncommunicative will respond best to an attempt at joviality. The child who is temperamental and hysterical will be controlled only by reprimand. The child who is incorrigible, with the proverbial "chip on the shoulder," who will not open his mouth and who makes unreasonable statements must necessarily be dealt with alone. The parent must be excused. It takes but a few moments alone with this type of patient to convince him orally that he will do just as you dictate. The work will be done pleasantly or unpleasantly, just as he chooses. Begin at once. It is merely a matter of "calling his bluff." Every child of this temperament, if he is convinced by your attitude that you mean business, responds at once.

Possibly a half dozen times in my practice, I have had to resort to the towel procedure to break down the iron will of an incorrigible patient. It is drastic, but the spirit must be conquered before the flesh will be subdued. It amounts to shutting off the air supply by holding a towel over the mouth, and over the nose eventually, if necessary, while admonishing him that he will be released when he agrees to do as you suggest. This may sound severe and unfair, but it is a last resort and need be used but infrequently. These children are always pampered at home, doing just as they wish, and it goes without saying that dental work cannot be done until this trait has been corrected. This type of individual, together with the temperamental and hysterical type, eventually makes the best patient. He proves an especially good friend thereafter because he admires anyone who can direct him. And he is the best advertiser—both he and his parent—that one could ever expect to have. With these patients as well as all others, we have all the unpleasantness over at the first appointment. After the patient learns that you mean exactly what you say, he responds and behaves well. Possibly the greatest asset in a juvenile practice is a disciplinary trait. Anyone who is a good disciplinarian—in other words, a good "boss"—will be successful with children.

It is unfortunate that the average dentist has so little interest in the dental care of the child. I believe that I recognize the cause and I venture to offer a remedial measure. When dental attention is given the child, in a general office, this is what usually happens: The mother has an appointment with the dentist Tuesday afternoon (no time is stipulated so she goes at the convenient time for her, 2:30 p. m.—incidentally, the convenient time for all other patients). She arrives bringing the patient with her because he was awake a part of the night with an aching tooth. She waits from fifteen minutes to an hour for her "turn." She enters and has her designated work done. When it is finished, she casually remarks to the dentist, "Johnnie had toothache last night — I wonder if you will see what's the matter." The child is tired and impatient from waiting so long. The dentist is hurried; patients are waiting, and he has not any patience with a child anyway and, in this state of affairs, he proceeds. He finds the offending tooth after much coaxing and a futile attempt

at mental distraction. The cavity is large and the tooth is sore; he knows instinctively that for satisfactory work, time must be consumed, which he has not. So he puts in some temporary cement, charges one dollar and dismisses the patient. The dentist is overpaid. In ten days, the patient has a recurrence of the toothache, and the parent returns to parade the fact before a reception room full of select patients that "the filling came out." These things make dentistry for children undesirable.

If the dentist will make a stipulated, definite appointment of thirty minutes (which is long enough for any patient under 5 or 6 years); be ready when the little patient arrives; feel assured that it isn't necessary to complete the whole mouth of six or eight fillings at the first sitting, as is commonly expected by both parent and operator; feel contented that he has thirty unmolested minutes to do something constructive, and then exact a fee commensurate with the time employed and the service rendered, he will find a new interest in dental service for the child.

In considering the matter of pulpless deciduous teeth, there are a few pertinent facts well worth going over.

The retention of infected deciduous teeth has been vastly overdone by the dentists in my locality. So much has been said in the last few years about space retention that has been taken entirely too literally and too frequently been practiced at the expense of the health of the child. Much as I appreciate the value of the maintenance of the deciduous teeth, I realize that the health of the child during the developmental years is of greater importance than the matter of irregular teeth. Regardless of age or physique or possible jaw deformity, I believe that all roots and badly infected teeth should be removed. By badly infected teeth, I mean those that are shown on roentgen-ray or surface examination, to be hopeless as far as treatment is concerned. The treatment of infected teeth in children of low resistance or below par is contraindicated. There are, however, a great number of putrescent teeth and teeth with acute infections that respond splendidly to treatment.

Last year, in going over the records in my office covering a period of five years, I found that 95 per cent of all treated pulpless deciduous teeth were maintained and exfoliated normally at the exfoliation period. My procedure has not been to treat every devitalized tooth that I encounter, but to select those that, from experience, I believed would respond. In the course of a year, I treat a large number of these infected deciduous teeth.

In a general practice, you may assume off hand that this procedure is far-fetched and not indicated, as well as being unprofitable. That may be true, generally speaking, but all of you have had children of the better families for whom you would do most anything possible to maintain an occasional infected tooth; for instance, in an undetected proximal cavity with sufficient caries, resulting in devitalization while you have had the child under your constant and periodic care, or, as will occasionally happen, devitalization and an acute abscess following the insertion of an amalgam filling. In the eye of the parent, the extraction of an acutely abscessed tooth, which has been under your periodic care, suggests considerable carelessness on the part of the operator. From the parent's point of view, the extraction of an offending tooth a few days subsequent to the insertion of a filling bears a mercenary tinge and suggests faulty diagnosis. We might add to this the obvious chagrin on the part of the

operator. These are two specific cases in which a few simple suggestions for the retention of teeth so infected might be recommended and acceptable. To reiterate, "wholesale" root-canal work in deciduous teeth is no more recommended for children than for adults. In a strictly juvenile practice, much more of this type of work can be done, but, in general practice, it should cover, as with the adult patient, only the occasional tooth.

TREATMENT

Let me suggest and recommend a treatment for these cases. For convenience, we will divide these teeth into the putrescent, the acutely abscessed and that having an exposed nerve, or the partly devitalized tooth.

1. *Putrescent Teeth.*—In the case of the putrescent tooth, which we so frequently find in going over a mouth, the nerve is completely devitalized, and there is no swelling, and no pain, but a constant seepage. We open the pulp chamber of these teeth by cutting away the occlusal floor, remove the débris with an excavator, wash and seal in beechwood creosote. This can be left in for a period of a week in most cases. If the field is kept dry at the next sitting, the contents of the canals can be removed with a barbed broach, the canals dried and the filling material inserted. Some of these cases will require a second treatment.

2. *Acute Abscess.*—In the case of the acute abscess, and the commonly seen swollen face, the procedure at the initial visit is simply to open for drainage. This can be done with an excavator, explorer, root-canal file or small round bur. The patient is dismissed for a few days for the swelling and soreness to subside. On the return call, the contents of the pulp chamber only are removed, and formocresol is sealed in, and is left for two days. The canal is opened and the contents are removed. We then dry the canal and seal in beechwood creosote for a matter of from two or three days to a week, this depending on the convenience to the patient and operator. I have found that little instrumentation should be done in these canals. We use nothing but a barbed broach and keep in mind that the canal in a tooth that is being resorbed is much shorter than the estimated length of the root. This is due, of course, to resorption occurring more rapidly on the inside of the root than on the outside. I have found also that instrumentation in these canals can be done as well in a moist field as a dry. I have been unable to distinguish any difference in the end-result. At the next sitting, the tooth is isolated and kept free from moisture while the filling is being inserted.

3. *Exposed Pulps or Partly Devitalized Teeth.*—Pulp-capping for deciduous teeth is a hazardous process, involving mostly disaster. In an exposure, either from instrumentation or from caries, or with a cavity that is so deep that I think there is any possible chance of devitalization whatever, I devitalize. I do this to protect myself. It is difficult to explain to the parent, unless he is well informed at the time of the filling, why a tooth becomes devitalized, and it is particularly more difficult to collect for the subsequent extraction or the subsequent treatment and root-canal work. I am aware of the criticism regarding the use of arsenic or devitalizing fiber in deciduous teeth. It has been used in my office for the past seven years, with only two cases of arsenic necrosis, and these of minor import. One of these cases was due to a delayed appointment and the other due to my failure to examine the tooth with the roentgen rays at the initial appointment. One root was completely resorbed.

Frequently, a tooth that is so devitalized can be filled at the next sitting, which is approximately three to four days later.

The root-canal filling material which I have used for the past few years is the powder of Rickert's root-canal filling material mixed with a liquid composed of an ounce of glycerin in which has been dissolved a crystal of iodin of the approximate size of a pea. This liquid and powder is mixed to a creamy paste and inserted in the canals with a smooth broach with a pumping motion. Cement is then forced into the pulp chamber, which, in turn, helps to force the material into the apices. There are many other root-canal filling materials on the market. I have used this with splendid success the last four years.

Deciduous root-canal work should be actively incorporated in the routine of the child specialist. It is simple, effective and constructive.

DISCUSSION

Charles A. Sweet, Oakland, Calif.: I wish to approve the thirty-minute appointment for the child. Most of us make the mistake of not giving the child sufficient time. I would like to add that the thirty minutes should be given to them, when they have been suffering from a toothache for possibly a night or two, in the morning and not in the afternoon after they have spent the day in school and are exhausted not only from the suffering and loss of sleep but also from a trying day in the classroom. In speaking to one of our educators, I was informed that a child did not learn as much from 3 to 6 o'clock, or on Saturdays as he did in the morning hours because he was tired. Naturally, dentists cannot expect full cooperation from the child during these unfavorable hours. If we would all insist on morning appointments when the case is acute, we would not only get along with the child better, but I am sure we would also be able to do better dentistry. There are two questions that I wish to ask: 1. Do you ever treat acutely abscessed teeth? 2. What rules may be laid down to determine when we may successfully treat a pulpless deciduous tooth and when extraction is indicated? I may have misunderstood Dr. McBride in his statement that we may operate in a dry or a wet field, but my suggestion is that since a dry field is never an impossibility, we should not handicap ourselves with a wet one. From the standpoint of a successful private practice, Dr. McBride's statement regarding pulp exposure is hazardous. To have a tooth filled today and then ten days or so later have it abscess always raises a question in the parent's mind as to whether the dentist is really competent.

T. D. Gates, Washington, D. C.: As regards the dentist's saying, "I can't be bothered": I have heard that statement, from the time I started to dental school. It is our duty as dentists to convince the patient that we can and should be bothered. That is the reason the great campaign for prevention has been started and the child's tooth is being taken care of from the grade school up. If we educate the parent that we can be bothered and that the child is our future patient, preventive dentistry will start with the child, not after we get the patient as a grown up, when the treatment must be corrective. I am a believer in root-canal work in its proper phases, so I would like to change the phrase "devitalizing a tooth" to "devitalizing the pulp." Many will say that the tooth is dead. I am not convinced that when the pulp is devitalized, the tooth is entirely dead.

Dr. McBride (closing): With regard to treatment with the mother present. I tell the parents that I can work faster and have better patients if I have them alone. If the parents wish to come into the room, I permit them to come. The parent is paying the bill. I get annoyed sometimes when I have something done for me or my family and I am not permitted to stand by and observe. If the parent wishes to come into my operating room and delay my procedure at her own expense, that is agreeable to me, with the exception, of course, in the case of the incorrigible child. I find that I can make a child appear bigger in his own estimation if his mother is not there. I can ask him about his dad, or his mother or the family, or the automobile, and he feels much bigger if he answers my questions than if I ask the mother how the father is. My patient is a big boy. He is in there talking to the dentist. And while we are on that subject: I allow my

dental assistant to say nothing. I know how you feel when you go to a dentist and he is in the room: You want to talk to him. The minute he is out of the room, you are perfectly satisfied to talk to the nurse. I make that a cardinal rule. My nurse says little or nothing, except when I am out of the room. There was a question about treating the putrescent tooth before putting in the filling. I dry the tooth with cotton points for as far as I can go into the canal, taking care that I do not start hemorrhage. I then put in the root canal filling. Zinc oxid is used in filling sometimes, but when the tooth is lost, we find that there is not a vestige of the filling material left. There seems to be a suction of some kind there which seems to pull the soft material out of the pulp chamber, and quite frequently before that is lost, there is a recurrent infection. The root canal filling that I am using is hard enough to set firmly and yet can be resorbed as the tooth comes out. Infection in the deciduous tooth is between the roots, not at the apices, and drainage is through the chamber into the mouth. That is my theory at least. I do not, in my own practice, treat any teeth of children who do not look well or who have had any bad medical history. I do much work in conjunction with pediatricians. When I learn from them that a child has a pathologic condition, I never devitalize or treat any teeth—I extract them. With the average patient coming in for a routine examination, or with a new patient, if I find a putrescent tooth and no complaint or history of ill health, I treat the tooth. Children's fear of the dentist is largely the result of the attitude of the parents. Then I have had children who made excellent patients until they entered school and heard some gruesome tale about somebody having a dreadful time at the dentist. In answer to Dr. Sweet's question: I do treat acutely abscessed teeth. If they are badly abscessed and I get no drainage when I open the chamber, I extract the tooth. If I get drainage, I proceed to treat the tooth. As to instrumentation in a dry or a wet field, I know that a dry field can be maintained in a child's mouth if we have an assistant. I do a great deal of work in a dry field. I do possibly half of my own instrumentation in a moist field, and I cannot see any difference in the end-result. It was advocated at the University of Michigan at a clinic last year. I was surprised to see that it was done with permanent teeth. The average teeth I treat will be retained from one to six years. As regards the statement that 95 per cent of the teeth that I have been treating are exfoliated normally. I know that some patients who come to my office and later have trouble with a tooth treated by me will go to another dentist. I did not do the work well in their estimation. I take all that into consideration, but the actual average that I had in my own office was slightly less than 94 per cent. I have added enough to that for patients who did not come back with any trouble to account for the other 1.5 per cent. That means that I treated these teeth and they exfoliated normally. They may have exfoliated six months or a year earlier, as I said before, because a pulpless tooth will resorb faster than one that is vital. But a new tooth is there, and we have all the advantages that we wish to gain. Two years ago, in Detroit, during an epidemic of measles, smallpox and chickenpox, we were called to extract teeth at the homes, in several cases. On looking up the case history, we would find that the tooth had been normal for three or four years, and then broke down under illness. That is the same thing that happens with the adult mouth. As regards the devitalization under amalgam fillings: I do not know whether it is a result of shock or of pressure. I think that half of it is due to the fact that we have misjudged the condition of the pulp when we placed the metallic filling. I put in a lining of red copper cement under all metallic fillings, because it eliminates the irritation. I sterilize with hexylresorcinol. In a pit of unusual depth, I place a copper cement lining. Another reason that some of these fillings result unfavorably is that they are left too high. That is why many of the fillings are lost. The child bites on it before it is set and there is a check in the filling. As to sending the incorrigible patient to the clinic, possibly that would help. I have had children come to me who have been to many other dentists and got nothing done. The dentist coaxed the child; he diagnosed the trouble and not the patient. If we discipline that child, he will be more agreeable. It may be better to send the incorrigible patient to the clinic to see what the other boy and girl does; but the minute I start sending my patients to the clinics, I am out of business.

PROCEDURE FOR TREATMENT OF EXPOSED AND PULPLESS DECIDUOUS TEETH*

By CHARLES A. SWEET, D.D.S., Oakland, Calif.

THE management of exposed and pulpless deciduous teeth is no longer experimental. They respond so promptly to treatment that there is no shadow of doubt as to the advisability of retaining them. The following procedure for exposed pulps in deciduous teeth is submitted after ten years' use, and, if followed carefully, will prove successful in every instance as far as all available records will show.

1. At the first visit, as much caries is removed as is practical, with as little pain to the patient as possible. Only enough retention is necessary to hold a temporary filling. A devitalizing wafer is cut in half, saturated with 95 per cent phenol and placed directly over the exposed area. This is sealed in with a temporary filling, the cavity being kept dry with cotton rolls. The patient is dismissed for forty-eight hours.

2. At the second visit, the tooth is isolated with cotton rolls and wiped off with alcohol, and the devitalizing substance removed. Without any further removal of caries, formocresol is sealed in with a temporary filling for another forty-eight hours.

3. At the third visit, all exposed teeth are sterilized to the best of one's ability, the tooth being kept free from saliva by the use of cotton rolls. The second filling substance is removed, and, by the use of a fissure bur, the pulp chamber is completely opened, so that all corners are clearly exposed. The bulbous portion of the pulp is removed with spoon excavators, the pulp fragments in the root canals proper remaining undisturbed. With a temporary filling, another treatment with formocresol is given for three to four days.

4. At the fourth and last visit, the teeth are again isolated and sterilized, cotton rolls and the saliva ejector being used if necessary. The filling substance is then removed and a drop of hydrogen peroxid is placed in the pulp chamber to remove any stain. The pulp chamber is dried thoroughly with warm air and filled with a creamy mixture of zinc oxid and eugenol. With a pellet of cotton slightly larger than the cavity, this paste is forced into the orifices of the root canals and a thin covering is allowed to remain on the floor of the pulp chamber, which is now filled with crown and bridge cement, and the tooth is restored permanently.

Some time later, if the filling in one of these teeth so treated is removed and root canals are gone into, we may cause a hemorrhage, but apparently there is no sensation.

Figure 1 shows the teeth with pulp exposed. They were treated in October,

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-First Annual Session of the American Dental Association, Washington, D. C., Oct. 9, 1929.

1923, and roentgenographed, June 27, 1929.

TREATMENT FOR PULPLESS DECIDUOUS TEETH

Not all pulpless deciduous teeth can be successfully treated, and in the following cases, extraction is necessary.

1. All deciduous teeth in which two-thirds of the roots has been absorbed because of either normal absorption or infection.

2. All deciduous teeth in which caries has penetrated the bifurcation of the roots.

3. All deciduous teeth with fistulas opening at or around the gingival margin of the tooth.

Pulpless deciduous teeth that should be treated I shall divide into two groups:

1. Deciduous teeth having putrescent or gangrenous pulps but presenting no indication of either a fistula or a sinus.

2. Deciduous teeth with putrescent or gangrenous pulps with fistula or sinus.

Treatment of Group A.—1. On the first visit, the pulp chamber is thoroughly opened and all caries removed. The pulp chamber is washed out with a warm spray

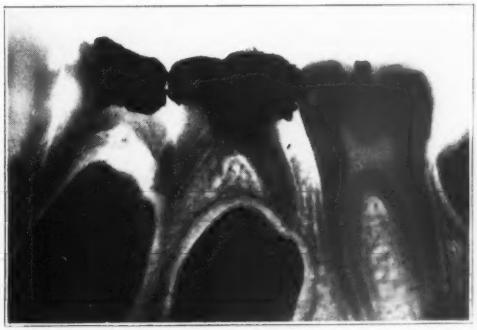


Fig. 1.—Teeth with pulp exposed; treated in October, 1923; roentgenographed, June 27, 1929.

Fig. 2.—Teeth successfully treated in 1925; roentgenographed in September, 1929.

and any particles that can be seen are removed with spoon excavators and explorers. After the cavity has been dried, a treatment of formocresol is sealed in for forty-eight hours with a temporary filling.

2. On the next visit, the teeth are isolated, cotton rolls and saliva ejector being used if necessary, and sterilized. The first filling is removed and the upper one-third of the root canals thoroughly cleaned out with a broach, care being observed that we do not pass the broach too far down the canals and so force infected material through the apex. Formocresol is again sealed in with temporary stopping and the patient is dismissed for three or four days.

3. At the third visit, the root canals are completely cleaned out with a broach after all necessary precautions have been taken to keep the tooth free from saliva or contamination. The tooth is made ready to receive the root-canal filling and

Fig. 3.—Tooth treated by use of the rose head bur in 1925; roentgenographed in 1929.

Fig. 4.—Root-canal work done in 1921. The roentgenogram was taken in 1924. The teeth were lost normally in 1927.

restoration as no further cleansing will be done. Formocresol is again sealed in with a temporary filling for three or four days.

4. At the fourth appointment, the tooth is isolated with cotton rolls, thoroughly washed with alcohol and kept free from saliva by the saliva ejector. The filling substance is removed, and a thick creamy paste of zinc oxid and eugenol is placed in the pulp chamber and forced into the root canals with a pellet of cotton. This paste may be forced farther down the canals by the use of root-canals

Fig. 5.—Pulp exposure (upper left deciduous incisor) in an infant, aged 20 months. The tooth was treated in August, 1924. The upper deciduous central incisors, which were putrescent, were treated. The root canals were filled in 1924. The teeth were normally lost.

pluggers if necessary. The pulp chamber is filled with crown and bridge cement and the tooth restored with a metal. Figure 2 shows the teeth successfully treated in 1925, and roentgenographed in September, 1929.

Treatment for Group B.—(Deciduous teeth with fistula or sinus.) Deciduous teeth with a fistula or sinus are treated identically in the manner of those without fistulas as described above, but occasionally the fistula will not heal. In case the fistula does not disappear at the last appointment, after the metal restoration is in place, the following treatment is advisable:

After application of a local anesthetic, with the contra-angle handpiece a large rose head bur previously dipped in 95 per cent phenol is inserted in the fistula opening, all necrosed tissue being removed until sound bone or tooth structure is encountered in all directions. A wick saturated with camphorated phenol is placed in the opening, with instructions to the parent to remove it just before retiring, after the last meal of the day is eaten and the mouth has been thoroughly cleansed. Usually, the healing process is so rapid that the wick, if not packed in too tightly, will be forced out in from twelve to twenty-four hours.

Figure 3 shows the tooth that was treated by the use of the rose head bur in 1925. The roentgenogram was taken in 1929.

Figure 4 shows root-canal work done in 1921. The film was taken in 1924. The teeth were lost normally in 1927.

Figure 5 shows a pulp exposure (upper left deciduous lateral incisor) in an infant, aged 20 months. The tooth was treated in August, 1924. The upper deciduous central incisors, which were putrescent, were treated. The root canals were filled in 1924. The teeth were lost normally.

242 Moss Avenue.

TWENTY-THREE YEARS OF PREVENTIVE DENTISTRY*

By TRIM HOUSTON, Corsicana, Texas

OF late, much stress has been placed on regular mouth examinations for children, followed by a careful correction of all defects, especial emphasis being placed on preventive odontotomy.

A résumé of what has been accomplished along this line in one institution covering a period of twenty-three years should be of interest.

In 1907, the children in the home of one of our benevolent orders were placed in my care, from a dental standpoint. A free hand was given me to do what I thought best.

A child, 16 years old or younger, of a member of the order who dies leaving an estate of $2,000 or less is entitled to the benefits of the home. No adoptions are allowed; but the mother may, at the discretion of the trustees, remove her children. The rule is that they receive their discharge following their eighteenth birthday, but this rule is not strictly enforced, the best interest of each particular child coming first.

The home is located in the suburbs on a large tract of land, with the dormitories, dining hall, classrooms, auditorium and gymnasium, and hospital each a separate building. Thus, the children are well housed. They get enough outdoor life as there are few days in our climate disagreeable enough to keep one indoors.

Practically all the children are of native born parents, the admixture of foreign bood being negligible. Efforts to get family histories have not been sufficiently illuminating to be of value. But few have had any dental attention other than extractions.

On entering, a child is put in quarantine for two weeks, to ensure that no infectious diseases are brought into the home, and to give the physician, the rhinologist and the dentist a chance to make careful examinations. Thereafter, they are examined at regular intervals, varying from one month to one year, depending on each child's needs.

Occasionally, congenital defects are found: a few supernumerary teeth, a number of cases of brown stain and mottled teeth, a very infrequent hutchinsonian tooth; and there were many defects which could be traced to dietary deficiencies. The gums and alveolar process show the baneful effects of kidney lesions and other constitutional disturbances. A very few of the children have need of orthodontic attention, and these mainly because of the too early or too late loss of the temporary teeth. Some whose bodies are not symmetrically developed have most frequently either an overdevelopment or an underdevelopment of the premaxillary bone.

These children have all the fresh whole milk that they will drink, a minimum of meats, about one-third the average sugar, plenty of fruits and vegetables and very few pastries. Practically no sweets are consumed between meals.

In keeping with my instructions, no dentifrices have ever been furnished the children. All dental defects are filled as soon as deep enough to catch an explorer. Gingivitis is watched out for persistently.

In considering the figures given, it should be borne in mind that a few of the children are removed from the home after a residence of a year or so; some to return later. A few of the 7 to 16 years old children have at the time of entrance lost the lower first molars, especially. Some stay longer than their allotted time. Numerous roughened places are polished as smoothly as well can be and treated with silver nitrate. Of these, no record is kept.

The number of boys and of girls is approximately the same; yet in spite of the fact that the girls give little trouble as to the brushing of their teeth and the average boy gives continual trouble, there is no appreciable difference in the number of cavities as between girls and boys.

A number of teeth, especially the lower first molars, were filled with copper cement, this being later replaced by a more permanent material. The teeth most often affected are, in order: the lower left first molar, the lower right first molar, the lower left second molar, the upper left first molar, the upper right first molar.

During this period, 938 children have passed through the home. For these children, three permanent teeth have been extracted as a result of decay. This does not include, of course, teeth that were hopeless at the time of entrance. Altogether 1,304 fillings have been placed in permanent teeth. In nine teeth, nerves have been removed (nerves not exposed when the child entered the home). These have all occurred as a result of recurrent decay at the gingival edge of proximal cavities.

Of these 938 children, 210 came in at from 1 to 6 years of age. Of these 210 children, 153 spent their allotted time at the home without needing fillings in the permanent teeth. For the other fifty-seven, 144 fillings were placed in permanent teeth, practically all these being on the buccal surfaces of the lower molars and the occlusal surfaces of the lower and upper first molars.

For 428 children who came in at from 7 to 12 years of age, 737 fillings were placed in permanent teeth. As to the location of the defects, two were labial, sixteen lingual, 133 buccal, 202 approximal, 809 occlusal; a total of 1,162.

The seeming discrepancy between 1,304 fillings and 1,162 defects is due to the fact that 142 defects were refilled.

Of the two labial defects, one was cared for during the first two years; of the sixteen lingual, twelve; of the 133 buccal, fifty-six; of the 202 approximal, 122; of the 809 occlusal, 370. Altogether, of the 1,162 defects, 561 were cared for during the first two years; which leaves 601 that developed during the remainder of the time.

The average child goes out with gums in a normal condition, the exception being those who have known or suspected constitutional disturbances.

The only moral to this story is "Catch them early and brand them young."

HISTORY AND CONTEMPLATED PROGRAM OF THE DIVISION OF ORAL HYGIENE, MARYLAND STATE DEPARTMENT OF HEALTH.

From 1924 to 1929, the Maryland State Dental Association, on record as favoring an oral hygiene program, investigated various ways and means of conducting such a program. Among other suggestions was the recognition and licensing of dental hygienists. A committee appointed to investigate this policy returned an adverse report and the plan was rejected.

In 1929, a bill was passed in the legislature and signed by the governor, authorizing the appointment of a dental member on the state board of health. In August, 1929, Governor Ritchie appointed Burt B. Ide, of Baltimore, to this position. There was also included in the state's annual budget an appropriation of $10,000 to be used in promulgating an oral hygiene program under the auspices of the state health department.

At their first meeting, after Dr. Ide's appointment, the state board of health, acting in accordance with his suggestions, created the division of oral hygiene and authorized R. H. Riley, state director of health, to employ a dentist to act as chief of the new division. In October, 1929, Dr. Riley appointed Richard C. Leonard, D.D.S., of Fargo, N. D., as chief of the division of oral hygiene. The latter assumed his duties, Nov. 15, 1929.

Dr. Leonard attended the Department of Arts and Sciences of Indiana University for three years, and the Dental Department of the same university from 1918 to 1922, graduating in 1922. He was resident dentist at the Indiana State School, 1922-1923. Following this period, he conducted a private practice for four years. In 1927, he was made director of the dental program of Fargo, N. D., child health demonstration under the auspices of the Commonwealth Fund of New York City.

The success of his activities at Fargo was brought to the attention of the health authorities of Maryland and, on investigation, his record was found so satisfactory that he was invited by the state board of health to take charge of the state oral hygiene program as chief of that division.

The State Board of Health of Maryland is fully alive to the importance of oral hygiene as a health measure; therefore, the newly appointed chief will enjoy the full support and cooperation of that body as well as the united support of the dental profession. This augurs well for a successful administration of the state's oral hygiene program.

NEW SET OF NEWSPAPER PUBLICITY ARTICLES

The American Academy of Periodontology has just completed an excellent new set of newspaper publicity articles. There are fifty-four separate articles in this set, all well written in a popular style.

To a dental society planning to put on a newspaper publicity campaign on mouth hygiene, this set of articles should prove very acceptable. They are being sold at the very reasonable fee of $2 per set. Send all requests to C. H. Schott, 1004 Neave Building, Cincinnati, Ohio, enclosing check with order.

ANNOUNCEMENT OF THE SUMMER SCHOOL OF DENTAL HYGIENE

I. Required Courses:

School Dental Procedures—Public Health Work. Eleanor G. McCarthy, D. H., consultant in dental hygiene, State Department of Public Health.

Principles of Teaching Health Subjects. Amy Hale Golder.

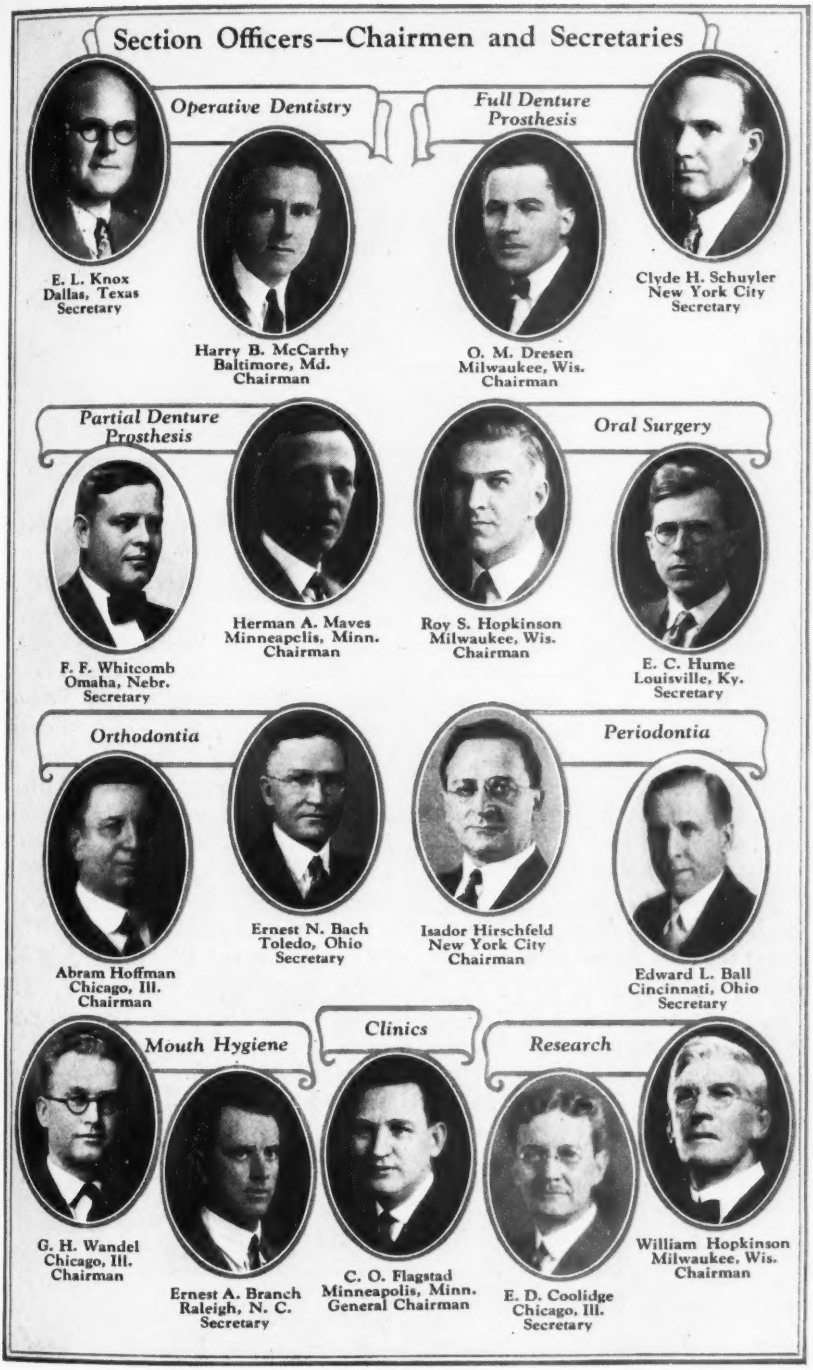
Nutrition. Esther V. Erickson.

Child Growth and Development. Clinton E. Carpenter.

II. Elective Courses:

Adult Alien Education, Factors Which Influence Health, Physical Education. Psychology of Social Adjustment.

These courses are open to graduate dental hygienists who are doing school work or who plan to do it. A certificate will be given on the completion of six courses, five being required and one elective. Expenses are the same as under the School Nursing Course. Make application to the Department of Public Health, State House, Boston.



CHAIRMEN AND SECRETARIES OF THE SCIENTIFIC SECTIONS OF THE AMERICAN DENTAL ASSOCIATION, 1930

AMERICAN DENTAL ASSOCIATION SEVENTY-SECOND ANNUAL SESSION

DENVER, COLO., JULY 21, 22, 23, 24, 25, 1930

OFFICIAL CALL

To the Members of the American Dental Association:

You are hereby notified that the Seventy-Second Annual Session of the American Dental Association will be held at Denver, Colo., July 21-25, 1930.

The House of Delegates will convene at 10:00 o'clock in the forenoon (for the entire day), Saturday, July 19; the second meeting (for the entire day) will be held on Monday, July 21, at 10:00 o'clock; the third meeting, on Wednesday, July 23, at 2:30 o'clock, and the fourth meeting, on Thursday, July 24, at 2:30 o'clock. The four meetings of the House of Delegates will be held in the Ballroom of the Brown Palace Hotel. The Credentials Committee will register Delegates and Alternates, beginning at 10:00 a. m., Friday, July 18, at the Brown Palace Hotel.

All other members will register at the Registration Office in the West Denver High School. The Registration Department will be open from 9:00 a. m. to 5:00 p. m., on Sunday, July 20, and from 8:30 a. m. to 5:00 p. m., on Monday, Tuesday, Wednesday, Thursday and Friday, July 21, 22, 23, 24 and 25.

The general meeting which constitutes the opening exercises of the Session will be held Tuesday, July 22, at 9:30 a. m., in the Denver Municipal Auditorium. The second and third general meetings will be held on Tuesday and Wednesday, July 22 and 23, at 7:45 p. m., in the Denver Municipal Auditorium.

The constituent societies are hereby notified to file with the Secretary of this Association, at least thirty (30) days prior to the first day of said Annual Session, a list of the names and addresses of their Delegates and Alternates.

R. Boyd Bogle, *President.*
Harry B. Pinney, *Secretary.*

GENERAL PROGRAM

Registration (General) ..... Sunday, July 20, 9:00 a. m.
(West Denver High School)

Registration (Delegates and Alternates) ..... Friday, July 18, 10:00 a. m.
(Brown Palace Hotel)

Board of Trustees (First Meeting) ..... Friday, July 18, 10:00 a. m.
(Brown Palace Hotel)

Board of Trustees (Second Meeting) ..... Friday, July 18, 2:30 p. m.
(Brown Palace Hotel)

House of Delegates (First Meeting) ..... Saturday, July 19, 10:00 a. m.
(Ballroom, Brown Palace Hotel)

House of Delegates (Second Meeting) ..... Monday, July 21, 10:00 a. m.
(Ballroom, Brown Palace Hotel)

House of Delegates (Third Meeting) ..... Wednesday, July 23, 2:30 p. m.
(Ballroom, Brown Palace Hotel)

House of Delegates (Fourth Meeting) ..... Thursday, July 24, 2:30 p. m.
(Ballroom, Brown Palace Hotel)

PRELIMINARY PROGRAM FOR DENVER SESSION

FIRST GENERAL MEETING

(Denver Municipal Auditorium)

TUESDAY, JULY 22, 1930

9:30 a.m. Prelude
10:00 Invocation
10:05 Music (Solo)
10:15 Address of Welcome from the State of Colorado
10:30 Greetings from the City of Denver
10:45 Address of Welcome from Colorado State Dental Association
11:00 Response of the American Dental Association
11:15 Music (Solo)
11:25 President's Address
11:45 Postlude

SECOND GENERAL MEETING

(Denver Municipal Auditorium)

TUESDAY, JULY 22, 1930

7:45 p.m. Prelude
8:00 Music (Quartet)

8:15 Address
8:45 Music (Quartet)
9:00 Address
9:30 Postlude

THIRD GENERAL MEETING

(Denver Municipal Auditorium)

WEDNESDAY, JULY 23, 1930

7:45 p.m. Prelude
8:00 Music (Quartet)
8:15 Address
8:50 Music (Quartet)
9:00 Postlude

FOURTH GENERAL MEETING

(Ballroom, Cosmopolitan Hotel)

THURSDAY, JULY 24, 1930

9:30 p. m. to 1:00 a. m Grand Ball (Formal)
In honor of retiring President, R. Boyd Bogle

Public Library, Denver, Colo.; containing nearly 300,000 volumes.

THE SCIENTIFIC SECTIONS

TUESDAY, JULY 22

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Section Room F, West Denver High School. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Harry B. McCarthy, Chairman..... ..... Baltimore, Md.
Edouard M. Hall, Vice Chairman..... ..... Kansas City, Mo.
E. L. Knox, Secretary.....Dallas, Texas

2 to 5 p. m.

"Oral Diagnosis"
By Elmer S. Best....Minneapolis, Minn.
Discussed by
A. Y. Russell.....Baltimore, Md.
William M. Storey.....Madison, Wis.

"Dental Medicine of Interest to the General Practitioner"
By Gerald D. Timmons..... ..... Indianapolis, Ind.
Discussed by
J. S. Hopkins.....Bel Air, Md.
John P. Buckley.....Hollywood, Calif.

"Gold Foil"
By James Mark Prime....Omaha, Nebr.
Discussed by
C. N. Johnson.....Chicago, Ill.
George M. Hollenback..... .....Los Angeles, Calif.

FULL DENTURE PROSTHESIS

(Section Room A, West Denver High School. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

O. M. Dresen, Chairman...Milwaukee, Wis.
Ralph L. Christy, Vice Chairman..... .....Denver, Colo.
Clyde H. Schuyler, Secretary.New York City

2 to 5 p. m.

"Oral Art"
By Kent K. Cross.....Denver, Colo.

"Biologic Conditions; Their Relation to Heredity and Environment as Regards Size, Form and Harmony of the Osseous and Dental Structures"
By C. N. Skinner.....Los Angeles, Calif.

"Stabilization and Articulation of Dentures"
By Georges Villain.....Paris, France

"Some Current Delusions in Full Denture Construction"
By Charles M. McNeely.Brooklyn, N. Y.

PARTIAL DENTURE PROSTHESIS

(Section Room D, West Denver High School. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Herman A. Maves, Chairman..... ..... Minneapolis, Minn.
E. L. Knox, Vice Chairman....Dallas, Texas
F. F. Whitcomb, Secretary....Omaha, Nebr.

2 to 5 p. m.

"Small Wire Clasp as Applied to Partial Dentures"
By Leo G. Pollock.....New York City
Discussed by
A. L. Nygard.....Dallas, Texas

"Predetermination of Occlusal Anatomy in Bridge Construction Before Operative Procedure"
By E. T. Tinker.....Minneapolis, Minn.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Section Room B, West Denver High School. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Roy S. Hopkinson, Chairman..... .....Milwaukee, Wis.
Earle H. Thomas, Vice Chairman..... ..... Chicago, Ill.
E. C. Hume, Secretary.....Louisville, Ky.

2 to 5 p. m.

"Influence of Diet on the Reduction of Fractures of the Jaw and Bone Regeneration"
By Sherman L. Davis (A.B., A.M., Ph.D.).....Indianapolis, Ind.

Symposium

"Gas Oxygen Versus Local Anesthesia in Minor Oral Surgery"
By J. W. Seybold.....Denver, Colo.

"Local Anesthesia Versus Gas Oxygen in Minor Oral Surgery"
By Howard C. Miller.....Chicago, Ill.

"Preoperative and Postoperative Considerations in the Extraction of Teeth"
By Boyd S. Gardner...Rochester, Minn.

ORTHODONTIA

(Section Room C, West Denver High School. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Abram Hoffman, Chairman..New York City
Max E. P. Ernst, Vice Chairman.....
.....St. Paul, Minn.
Ernest N. Bach, Secretary.....Toledo, Ohio

2 to 5 p. m.

"Nature's Space Maintainers, the Deciduous Teeth"
By John E. Gurley.San Francisco, Calif.

"Application and Use of the Newest Angle Orthodontic Mechanism"
By Homer M. Shelden.Kansas City, Mo.

PERIODONTIA

(Section Room H, West Denver High School. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

Isador Hirschfeld, Chairman.New York City
C. S. Kramer, Vice Chairman.....
.....Woodman, Colo.
Edward L. Ball, Secretary..Cincinnati, Ohio

2 to 5 p. m.

Symposium

"Gingivectomy Method in the Treatment of Suppurative Periodontoclasia"
By R. E. Johnson.....St. Paul, Minn.

"Flap Operation"
By Adolph Berger.....New York City

"Conservative Method (Subgingival Curettage)"
By H. J. Leonard.....New York City

"Suppurative Periodontal Pus Pocket; Its Treatment and Control by a Simple and Conservative Flap Operation"
By Olin Kirkland.....Montgomery, Ala.

Correlated by
Arthur H. Merritt.....New York City

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Section Room G, West Denver High School. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

G. H.Wandel, Chairman.....Chicago, Ill.
E. F. Sullivan, Vice Chairman..Boston, Mass.
Ernest A. Branch, Secretary..Raleigh, N. C.

2 to 5 p. m.

"Facts Demanding Serious Professional Consideration as Disclosed by Dental Contact with the Committee on the Cost of Medical Care"
By H. E. Phillips.....Chicago, Ill.

"Report of Committee on Standardization of Examinations and Records"

"Dentistry's Place in Public Health"
By C. T. Messner....Washington, D. C.

"Newspaper Publicity"
By Horace Van Valkenburg.....
.....Cleveland, Ohio

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Section Room E, West Denver High School. All subsequent meetings will be held in this room.)

OFFICERS OF SECTION

William Hopkinson, Chairman.....
.....Milwaukee, Wis.
Isador Hirschfeld, Vice Chairman.....
.....New York City
E. D. Coolidge, Secretary.....Chicago, Ill.

2 to 5 p. m.

"Reactions of the Dentinal Fibril to External Irritations"
By Theodore B. Beust...Louisville, Ky.

Discussed by
Percy R. Howe.....Boston, Mass.

"Arrest of Dental Caries; Chemical Analysis of Teeth"
By C. L. Drain.....Iowa City, Iowa

"Vitamin Tides and Their Expression in Seasonal Disease, Including Dental Disturbances"
By Weston A. Price....Cleveland, Ohio

WEDNESDAY, JULY 23

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Section Room F)

9 a. m. to 12 m.

"Histologic Studies of Living Tissue Reactions Associated with Pulpless Teeth that May Be Taken as Evidence of a Satisfactory or Physiologic Healing"
By Edward H. Hatton.....Chicago, Ill.

Discussed by
Claud W. O'Dell.....Kansas City, Mo.
John A. Marshall..San Francisco, Calif.

"Vincent's Infection"
By A. J. Thompson....Kansas City, Mo.

Discussed by
Bruce L. Taylor.....Washington, D. C.
William M. Reppeto.....Dallas, Texas

"Silicate Fillings, Their Use and Indications"
By R. J. Rinehart.....Kansas City, Mo.

Discussed by
George E. Roland.Oklahoma City, Okla.
Arthur R. McDowell.....
.....San Francisco, Calif.

FULL DENTURE PROSTHESIS

(Section Room A)

9 a. m. to 12 m.

"Studies, Investigations and Observations Pertaining to Occlusion, Teeth, Technic and Articulators"
By M. M. House.....Whittier, Calif.

PARTIAL DENTURE PROSTHESIS

(Section Room D)

9 a. m. to 12 m.

"Histologic and Roentgen-Ray Findings in Residual Infection"
By John Oppie McCall...New York City

"Eliminating the Tooth Cusp in Prosthetic Restorations, Using Inverted Cusp Teeth"
By Rupert E. Hall.....Chicago, Ill.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Section Room B)

9 a. m. to 12 m.

"Diagnosis and Treatment of Trigemial Neuralgia"
By A. W. Adson (M.D.).....
.....Rochester, Minn.

"Surgical Technic and Controlling Factors in Tooth Removal"
By Wilton W. Cogswell.....
.....Colorado Springs, Colo.

"Sinus Diseases in Children"
By T. E. Carmody (M.D.).Denver, Colo.

ORTHODONTIA

(Section Room C)

9 a. m. to 12 m.

"Treatment of the Open Bite"
By Elizabeth E. Richardson.....
.....San Francisco, Calif.

"Orthodontic Education"
By Arthur D. Black.....Chicago, Ill.

"Third Molar Interference"
By Paul G. Spencer.....Waco, Texas

PERIODONTIA

(Section Room H)

9 a. m. to 12 m.

"Periodontoclasia. Postoperative Reorganization of the Disorganized Dental Apparatus"
By J. K. Burgess.....New York City

"Histologic Study of the Influence of Function on Human Periodontal Tissues"
By Rudolf Kronfeld.....Chicago, Ill.

"The Case Against Traumatic Occlusion"
By H. W. MacMillan...Cincinnati, Ohio

Discussed by
Paul R. Stillman.....New York City

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Section Room G)

9 a. m. to 12 m.

"Future of the Dental Hygienist"
By Cora L. Ueland...Los Angeles, Calif.

"General Practitioner's Responsibility in the Prevention of Periodontoclasia"
By Arthur H. Merritt...New York City

"Visiting the Children by Radio" (A demonstration)
By R. E. Anderson...Long Beach, Calif.

"Hawaii Offers a Lesson in Dental Health Education to the States"
By Guy S. Millberry.....
.....San Francisco, Calif.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Section Room E)

9 a. m. to 12 m.

"How Should We Treat the Impacted Tooth, Taking Its History, Histology, Pathology, Anatomy and Surgical Possibilities into Consideration?"
By T. A. Hardgrove..Fond du Lac, Wis.

"A Report of the Successful Control of Dental Caries in Three Public Institutions"
By Russell W. Bunting. Ann Arbor, Mich.
Philip Jay .....Ann Arbor, Mich.
Dorothy G. Hard ..Ann Arbor, Mich.

"Recognition of Bacillus Acidophilus Associated with Dental Caries"
By Faith P. Hadley (M.S.).....
.....Ann Arbor, Mich.
Edna Delves (A.B.).....
.....Ann Arbor, Mich.

"Comparison of Normal and Pathologic Bone in the Alveolar Processes of the Maxillae"
By John A. Marshall.....
.....San Francisco, Calif.

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Section Room F)

2 to 5 p. m.

"Influence of Radiodontia on Operative Dentistry"
By Howard R. Raper.....
.....Albuquerque, N. M.

Discussed by
Clarence O. Simpson.....St. Louis, Mo.
Ira C. Brownlie.....Denver, Colo.

"Nutritional Facts that the Dentist Should Know"
By Wallace Seccombe..Toronto, Canada

Discussed by
O. H. Gaver.....Baltimore, Md.
J. Paul Wintrup.....Wilmington, Del.

"Local Anesthesia for the General Practitioner"
By Joseph P. Arnold....Houston, Texas

Discussed by
Howard C. Miller.....Chicago, Ill.
P. G. Puterbaugh.....Chicago, Ill.

FULL DENTURE PROSTHESIS

(Section Room A)

2 to 5 p. m.

"Relationship of Alveolectomy to Full Dentures"
By H. F. McGrane.....Omaha, Nebr.

"Registering Functional Positions of the Mandible in Full Denture Prosthesis"
By O. A. Ralston.....Ainsworth, Nebr.

"Impressions"
By F. M. Hight.....Houston, Texas

"Comparison of Methods of Impression Taking for Full Dentures"
By E. S. Smith.....Iowa City, Iowa

"Important Stepping Stone to Success, Esthetics"
By B. L. Hooper.....Lincoln, Nebr.

PARTIAL DENTURE PROSTHESIS

(Section Room D)

2 to 5 p. m.

"Report of Findings Relative to Casting of Partial Dentures"
By Wilmer L. Souder. Washington, D. C.

"Partial Dentures Versus Fixed Bridgework, with Special Reference to Treatment of the Investing Tissues"
By T. B. Hartzell...Minneapolis, Minn.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Section Room B)

2 to 5 p. m.

"Cleft Palate and Cleft Lip"
By William L. Shearer....Omaha, Nebr.

"Maxillary Sinus Infection of Oral Origin"
By Henry Sage Dunning. New York City

"Dental Economics; Its Practical Application Toward Higher Ideals in the Practice of Dentistry"
By George Wood Clapp. New York City

ORTHODONTIA

(Section Room C)

2 to 5 p. m.

"Routine Radiodontic Examination in Orthodontia"
By Clarence O. Simpson...St. Louis, Mo.

"Lingual and Labial Arches, and Various Types of Auxiliary Springs"
By Oren A. Oliver.....Nashville, Tenn.

"Dentist's Responsibility in the Prevention of Malocclusion"
By William R. Humphrey. Denver, Colo.

PERIODONTIA
(Section Room H)

2 to 5 p. m.

"Oral Manifestations of Systemic Disease"
By O. S. Philpott (M.D.). . Denver, Colo.
A. J. Markley (M.D.). Denver, Colo.

"Significance of Gingival Hemorrhage"
By I. A. Epstein..... St. Paul, Minn.

"Vincent's Infection"
By L. A. Jessen..... Santa Rita, N. M.

"Preventive Periodontia in Children's Dentistry"
By Walter T. McFall..... Macon, Ga.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY
(Section Room G)

2 to 5 p. m.

"The Dental Hygienist—Are There Indications for Variations or Changes in Her Training?"
By Lewis E. Ford.... Los Angeles, Calif.

"Are Dental Extension Courses a Success?
By Joseph B. Jenkins.....
.....Oklahoma City, Okla.

"An Analysis of Pennsylvania's Dental Program Covering Its Ten Years of Development"
By C. J. Hollister..... Harrisburg, Pa.

"Points of Common Interest to the Dentist and the Pediatrician"
By Henry C. Niblack (M.D.).....
..... Chicago, Ill.

"Proper Dental Care for the Child Patient"
By Thomas A. Gardner. Iowa City, Iowa

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)
(Section Room E)

2 to 5 p. m.

"New Technic of Filling Root Canals"
By John P. Buckley... Hollywood, Calif.

"A Report of Recent Dental Investigations"
By U. G. Rickert..... Ann Arbor, Mich.

"Normal Characteristics of the Gingivae and Their Relation to Pathologic Processes"
By W. G. Skillen..... Chicago, Ill.

THURSDAY, JULY 24

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS
(Section Room F)

9 a. m. to 12 m.

"Gold Inlays"
By Edward R. Hart..... St. Louis, Mo.

Discussed by
B. B. Ide..... Baltimore, Md.
Thomas W. Snipes..... Pasadena, Calif.

"Cavity Preparation and Filling Materials for Deciduous Teeth, with Special Reference to the First Permanent Molar"
By E. F. Sullivan..... Boston, Mass.

Discussed by
Juanita Wade..... Dallas, Texas
Walter C. McBride..... Detroit, Mich.

"Dental Economics"
By W. N. Miller..... Flint, Mich.

Discussed by
J. Ben Robinson..... Baltimore, Md.
Ralph R. Byrnes..... Atlanta, Ga.

FULL DENTURE PROSTHESIS
(Section Room A)

9 a. m. to 12 m.

"A Study in Full Denture Construction"
By the Pasadena Study Club,
W. H. Terrell, *Director*.....
..... Pasadena, Calif.

"Anatomy of the Mouth Relative to Full Denture Construction"
By Harold L. Harris. Minneapolis, Minn.

PARTIAL DENTURE PROSTHESIS
(Section Room D)

9 a. m. to 12 m.

"Dental Castings"
By W. S. Rice..... Chicago, Ill.

Discussed by
T. W. Maves..... Cleveland, Ohio

"Cavity Preparation in Relation to Inlay Fixed Bridge Construction"
By Charles H. Gietzen.... Omaha, Nebr.

Discussed by
Benjamin Sandy..... Minneapolis, Minn.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Section Room B)

9 a. m. to 12 m.

"Effects of Ultraviolet Visible and Infrared Radiation on Tissue"
By Charles Sheard (Ph.D.).....Rochester, Minn.

"Exodontia for the General Practitioner"
By Sterling V. Mead..Washington, D. C.

"Use and Application of Anesthesia in Children's Practice"
By Charles A. Sweet.....San Francisco, Calif.

ORTHODONTIA

(Section Room C)

9 a. m. to 12 m.

"Giving Dental Patients a Dietary Foundation"
By Henry F. Hoffman.....Denver, Colo.

"Influence of the Narrow Maxillary Arch on Nasal and Sinus Disease"
By Harry L. Baum (M.D.).....Denver, Colo.

PERIODONTIA

(Section Room H)

9 a. m. to 12 m.

"Raising the Bite to Relieve Occlusal Strain"
By J. A. Loughry.....Cleveland, Ohio

"Relation of Diet to General Health, and Particularly to Inflammation of the Oral Tissues and Dental Caries"
By M. T. Hanke (Ph.D.)...Chicago, Ill.

"Procedure in Examination for Periodontoclasia"
By Grace R. Spalding.....Birmingham, Mich.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Section Room G)

9 a. m. to 12 m.

"Influence of the Endocrine Glands on Oral Health"
By Floyd Eddy Hogeboom.....Los Angeles, Calif.

"Practical Nutrition Suggestions for the Dental Practice"
By Percy R. Howe.....Boston, Mass.

"Use of Prosthetics in the Practice of Children's Dentistry"
By F. Blaine Rhobotham....Chicago, Ill.

"Significance of Clinical Experience as Related to Prevention for the Child Patient"
By Lon W. Morrey.....Chicago, Ill.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Section Room E)

9 a. m. to 12 m.

"Importance of Normal and Abnormal Tooth Structure for the Progress of Dental Caries"
By F. J. Barker.....Chicago, Ill.

"Evidence Against the Conception of a Circulation of Lymph in the Dentin and Enamel"
By Samuel W. Chase (A.M., Ph.D.)..
.....Cleveland, Ohio

"Preliminary Report on Blood Counts and Urinalysis in Cases of Periapical Infection"
By Carrie K. Bryant (B.S.).....Philadelphia, Pa.
K. Polevitsky (M.D.).Philadelphia, Pa.

GENERAL CLINIC PROGRAM

THURSDAY AFTERNOON, JULY 24—FRIDAY, JULY 25

GROUP 1: COLLEGE CLINICS

Baylor University, College of Dentistry
F. W. Hinds, Dean.

"Iteco Veneering for Full Dentures and Student Technic"
A. L. Nygard

"Mouth Preparation"
O. E. Ranfranz

"Incisions"
J. D. Eoff

"Crown and Bridge and Casting Technic"
P. L. Knutzen

"Student Work in Dental Drawing"
M. M. Paule

Georgetown University, Dental Department
W. N. Cogan, Dean.
"Restoration of Fractured Incisal Angles"
D. S. Thorn
"Moving Picture on Oral Surgery"
S. V. Mead
"Full and Partial Impressions"
W. F. Colliton

Indiana University, School of Dentistry
F. R. Henshaw, Dean.
"Gold Foil"
John L. Wilson
"Root-Canal Procedure"
Gerald D. Timmons
"Full Denture Technic"
Karl H. Kayser
"Extracting and Anesthesia"
Harry D. Leer
"Roentgenographic Interpretation"
G. Thaddeus Gregory

University of Iowa, College of Dentistry
F. T. Breene, Dean.
"Fixed Bridgework"
A. O. Klaffenbach
"Full Dentures"
Ray V. Smith
"Pathology of the Hard Tissues of the Teeth"
O. E. Schlaubusch
"Children's Dentistry"
C. L. Drain

University of Minnesota, College of Dentistry
W. F. Lasby, Dean.
Group Clinic: Periodontoclasia
"General Considerations in Histology and Pathology"
Carl W. Waldron
"Diagnosis"
D. R. Clark
"Instrumentation"
Dorothea Radusch
"Treatment: Instrumental and Surgical"
Raymond E. Johnson
"Home Care"
Harold G. Worman
"Prophylaxis"
Ione Jackson
"Operative Dentistry"
J. M. Walls and H. C. Wittich
"Crown and Bridge"
E. A. Nelson
"Prosthetics"
R. W. Delton

College of Physicians and Surgeons of San Francisco, A School of Dentistry
A. R. McDowell, Dean.
"Operative Dentistry"
Harry A. True
"Prosthetic Dentistry"
Jack Werner
"Crowns and Bridgework"
B. C. Kingsbury
S. A. Schwartz
"Oral Diagnosis and Dental Pathology"
Don J. Aubertine
"Orthodontic Procedures"
Elizabeth E. Richardson
Frederick T. West
"Working Clinic on Casting Technic"
Thomas H. Forde

Lincoln and Lee University, Kansas City-Western Dental College
R. J. Rinehart, Dean.
"Crown and Bridgework"
R. J. Rinehart
"Prosthetic Dentistry"
Dayton Dunbar Campbell
C. G. Porter
"Operative Dentistry"
R. W. Edwards
C. W. Sawyer
"Removable Restorations"
J. D. Scott

North Pacific College of Oregon, School of Dentistry
Louis J. FitzPatrick, Dean
"Steps in Compound Impression Technic for Full and Partial Denture Construction"
David T. Chase
"Essentials of Oral Diagnosis and Roentgen-Ray Interpretation"
Henry C. Fixott
"Study of Volume Change of Plaster of Paris in Denture Construction"
Everett M. Hurd
"Orthodontia"
Charles H. Walrath

University of Tennessee, College of Dentistry
R. S. Vinsant, Dean.

"Gold Foil, Amalgam and Silicate Restorations"
R. S. Vinsant
W. J. Templeton
Webb B. Gurley

GROUP 2: SECTION CLINICS

Operative Dentistry, Materia Medica and Therapeutics

"Diagnosis and Estimation: Twin Fundamentals of Professional and Profitable Office Practice"
W. N. Miller.....Flint, Mich.

"Gold Foil, a Tooth Conserver as Well as a Tooth Preserver"
James Mark Prime.....Omaha, Nebr.

Full Denture Prosthesis

"Another Casting Technic"
B. L. Hooper.....Lincoln, Nebr.

"Registering Functional Position of the Mandible in Full Denture Prosthesis"
O. A. Ralston.....Ainsworth, Nebr.

"Repair of Palatal Defects"
Henry Sage Dunning....New York City

"Different Phases of Full Denture Construction"
Group Clinic: National Society of Denture Prosthetists.
I. Lester Furnas, Director.....
.....Cleveland, Ohio

Partial Denture Prosthesis

"Cavity Preparation in Relation to Inlay Fixed Bridgework"
Charles H. Gietzen.....Omaha, Nebr.

"Dimensional Dental Castings"
W. S. Rice.....Chicago, Ill.

"Small Wire Clasps as Applied to Partial Dentures"
Leo G. Pollock.....New York City

"Predetermination of Occlusal Anatomy in Bridgework"
E. T. Tinker.....Minneapolis, Minn.

"Dimensional Dental Castings"
W. S. Rice.....Chicago, Ill.

"Movable-Removable Bridgework"
C. W. Holtzman....Minneapolis, Minn.

"Application of Principles in Design of Partial Dentures"
George W. Boos....Minneapolis, Minn.

"Impression Technic for Partial Dentures Including Preservation of Occlusal Tooth Form"
Ralph H. Boos.....Minneapolis, Minn.

"Spring-Lock Insertion Bridge"
Ferdinand G. Neurohr..New York City

Oral Surgery, Exodontia and Anesthesia

"Diagnosing Nutritional Deficiency in Dental Caries"
Sherman L. Davis....Indianapolis, Ind.

Periodontia

"Preventive Periodontia in Children's Dentistry"
Walter T. McFall.....Macon, Ga.

"Food Impaction"
Isador Hirschfeld.....New York City

"Open Operation in the Treatment of Pyorrhea Alveolaris"
Adolph Berger.....New York City

"Periodontoclasia—Postoperative Reorganization of the Disorganized Dental Apparatus"
J. K. Burgess.....New York City

"Gingivectomy Method in the Treatment of Suppurative Periodontoclasia"
R. E. Johnson.....St. Paul, Minn.

"Simple Surgical Flap Technic in Treatment of Advanced Periodontal Pus Pocket"
Olin Kirkland.....Montgomery, Ala.

"Gingival Crevices"
Rudolf Kronfeld.....Chicago, Ill.

"Distribution of Stresses on Remaining Teeth and Tissues in Periodontia Cases"
J. A. Loughry.....Cleveland, Ohio

"New Method of Gum Massage and Prophylaxis Between the Teeth for Home Treatment of Pyorrhea"
V. D. Irwin.....Duluth, Minn.

"Restorative Dentistry as It Concerns the Periodontist"
Paul A. Edmand.....Chicago, Ill.

"Preventive Periodontia for Young Patients"
T. Sydney Smith...San Francisco, Calif.

"Method of Teaching Mouth Brushing to Patient at the Chair"
F. A. Bricker.....Hollywood, Calif.

Orthodontia

"Use of the New Angle Orthodontic Mechanism, the Edgewise Arch"
Homer M. Shelden....Kansas City, Mo.

"New Designs and Materials in Impression Trays"
F. C. Rodgers.....St. Louis, Mo.

"High Labial Appliances"
Harry A. Holder.....Nashville, Tenn.

"Impacted Teeth Treated Orthodontically"
Burton A. Hoffman.....Buffalo, N. Y.

"Space Maintainers; Appliances to Maintain the Space of Deciduous Teeth Which Have Been Prematurely Lost"
Howard D. Keeler....Des Moines, Iowa

"Special Mechanism for Distoclusion Cases"
B. F. Philbrook.....Sioux City, Iowa

"Simple Treatment of the Labioversion of Maxillary Anterior Teeth and Open Bite Cases"
Elizabeth E. Richardson.....
.....San Francisco, Calif.

"Locks for Lingual and Labial Appliances"
Paul G. Spencer.....Waco, Texas

"Chin Retractor"
W. E. Stoft.....Omaha, Nebr.

"Models Showing Conditions Before and After Treatment"
Blaine Truesdell.....Omaha, Nebr.

"Indirect Band Technic and Construction of the Lingual Arch" (Moving picture)
A. B. Brusse.....Denver, Colo.
J. Lyndon Carman.....Denver, Colo.

Research

"Practical Applications of Newer Data for the Reduction of Dental Caries, and for Augmenting Physical Vitality"
Weston A. Price.....Cleveland, Ohio

"Bacteriology of Vincent's Infection"
Theodore B. Beust.....Louisville, Ky.

"Tissue Changes in Experimental Orthodontia." (Research conducted under the auspices of the American Society of Orthodontists)
John A. Marshall..San Francisco, Calif.

GROUP 3: STATE ASSOCIATION INDIVIDUAL CLINICS AND GROUP CLINICS

Arizona

"Templet for Mounting Models"
John A. Lentz.....Phoenix

California State

"Children's Dentistry"
Doris M. George.....Berkeley

"Prosthetic Dentistry"
Frank H. McKevitt.....San Francisco

"Indirect Inlay Technic Using Alundum"
Frank L. Hart.....San Francisco

"Plastic Surgery"
Albert D. Davis.....San Francisco

"Anatomic Indications in the Preparation of Mouths for Dentures"
Henley E. Miller.....San Francisco

"Gold Foil Procedures"
Franklin H. Locke.....Oakland

California (Southern)

"Behavior of Vulcanite and Condensite"
C. J. R. Engstrom.....Los Angeles

"Periodontal Cases Showing Tissue Regeneration"
Maxwell M. Dixon.....Los Angeles

"Porcelain Jacket Crown Showing in Detail Steps of Construction"
S. E. Brice.....Hollywood

"Operative Dentistry and Inlay Restorations"
E. D. Shooshan.....Pasadena

"Physical Culture of the Gums after Pyorrhea Treatment" (Moving picture)
Chester B. Parkinson.....Los Angeles

"Accurate and Simple Method of Registering: 1. Centric Occlusion. 2. All Possible Excursions of the Mandible. 3. New Precision Instrument for Determining the Foregoing. 4. Transfer of the Same to an Articulator"
Carl G. Shafor.....Los Angeles

"Face-Bow as a Measuring Instrument in Determining the Axis in Restoring Cuspal Coordination"
Morris J. Thompson.....Los Angeles

"The Bite-Wing Roentgenogram as an Aid to Diagnosis"
O. J. Nordeen.....Los Angeles

"A Study in Full Denture Construction"
Pasadena Prosthetic Study Club
Wilfrid H. Terrell, Director
Ralph M. Rogers
Glen C. Barry
Fred M. Garrett
John R. Crockett
Elgin Hyde
Douglas W. Kerr
Herbert E. Capps
Francis B. Gerry
C. A. Getschine
Austin Parker
W. F. Lewis

"Extraction of Teeth, Using Hand Pressure Instruments (Demonstrating on Models)"
Oral Surgery Clinic.....Los Angeles
Berto A. Olson, Director
C. Maynard Woodard
C. Stanley Rice

"Bridgework, Fixed and Removable"
Dental Arts Study Club.....Los Angeles
George M. Hollenback, Director
Guy B. Baird
Leroy E. Knowles
Arthur J. Quesnell

Connecticut

"Fractures of the Mandible and Maxillae"
William D. Nesbit, Jr.....New Haven

District of Columbia

"Full Denture Instruction"
S. S. Jaffe

"Where Preventive Dentistry Begins, or the Effect of Diet on the Teeth"
F. I. Bartlett

Florida

"Effective Root-Canal Technic, Including Cases of Fractured Roots and Reimplantation"
George M. Shields.....Miami

"Porcelain and Gold Inlay Attachments"
Z. N. Wright.....Miami

"Method of Floating and Registering the Movements of the Mandible and Its Application to Balanced Occlusion in Denture and Bridge Prosthetics"
L. E. Owen .....Miami

"Partial Denture Restorations"
J. P. Getzen.....Lakeland
C. J. Caraballo.....Tampa

"Exodontia"
A. Malcolm Smith.....Tampa

Georgia

"Porcelain"
J. G. Williams.....Atlanta

"Anatomic and Esthetic Fixed Bridges"
D. Hoyt Simpson.....Atlanta

"Construction of Partial Dentures"
J. W. Lynn.....Atlanta

Illinois

"Root-Canal Therapy"
Lucien H. Arnold.....Chicago

"Root-Canal Therapy"
J. Roy Blayney.....Chicago

"Partial Dentures One-Piece Castings"
Raymond M. Bondy.....Chicago

"Demonstration of the Uses of Low Fusing Porcelain Stains and Glazes in Producing Natural Tooth Shades"
William R. Eberle.....Chicago

"Cast Gold Inlays, Combination Investment Expansion and Wax Expansion Technic"
Albert P. Grunn.....Chicago

"Denture Construction"
Rupert E. Hall.....Chicago

"Comparative Study of Jaw Anatomy and Roentgen-Ray Diagnosis"
Edward H. Hatton.....Chicago

"Orthodontic Aids"
Abram Hoffman .....Chicago

"Simplified Casting Technic for Full and Three-Quarter Crowns, Inlays and Other Attachments Using an Expanding Investment"
Lester D. Kaplin.....Chicago

"Full Dentures; Method for Securing Accurate Impressions of Flabby Ridges and Spongy Borders"
Kermit F. Knudtzon.....Chicago

"Fixed Crowns and Bridges"
H. W. Oppice.....Chicago

"Survey of Dental Diagnosis for Children"
F. Blaine Rhobotham.....Chicago

"Technic for Surgical Treatment of Pyorrhea" (Diagrammatic Illustration)
Harold G. Ray.....Chicago

"Why Some Surgery Should be Applied in the Removal of All Teeth"
George Schneider .....La Salle

"Dental Roentgenogram as a Factor in Choice of Anesthetic"
Robert J. Wells.....Chicago

"Economics of Dentistry"
M. D. K. Bremner.....Chicago

"Inlays"
Arthur F. Bruening.....Niles Center

"Selection of Teeth for the Unusual Edentulous Condition"
R. H. Johnson.....Chicago

"Selection of Material for Impression Taking for Full Dentures"
E. C. Pendleton.....Chicago

Indiana

"Direct-Indirect One Piece Casting"
V. H. Knapp.....Evansville

"Roentgenographic Check-Up on Practical Pyorrhea Cases"
Daniel G. Mertz.....Fort Wayne

"Partial Dentures"
J. B. Carr.....Indianapolis

"Orthodontia"
William A. Kemper.....Indianapolis

"Practical Full Denture Technic"
Leonidas F. Smith.....Indianapolis

"Bite Locks and Bite in Full Denture Construction"
J. C. Weatherholt.....Fort Wayne

Iowa

"Practical Method for Construction of Cast Abutments and Inlays"
Charles G. Sanner.....Dubuque

"Home Care of the Gums and Teeth, and Correct Method of Manipulating the Toothbrush"
W. J. Charters.....Des Moines

"Pathologic Studies on the Third Molar"
R. C. Matteson.....Sioux City

"Necessity for and Ease of Filling Pit and Fissure Cavities, Class 1, with Gold Foil at First Sign of Decay, Especially in Young Patients"
F. D. True.....Des Moines

"Practical Partial Dentures. Dependable Designs and Type of Attachments Replacing Teeth Distad from Cuspids in Lower, also First and Second Bicuspids and First Molars in Upper Jaw"
J. P. Schneberger.....Ossian

"First Molar Protection"
E. D. Jack.....Cedar Falls

"Cast Overlay Anchorage Space Maintainer; Inlay Restoration for Deciduous Molars"
A. A. Plagman.....Davenport

"Investing, Elimination and Casting of Gold Inlays"
Emory O. West.....Des Moines
Carl T. Ostrem (assisting).....Ankeny

"Hereditary Traits Shown in Enamel Formation and in Jaw Relationship"
L. E. Weyer.....Iowa City

"Treatment and Control of Pyorrhea"
R. A. Greenawalt.....Cedar Rapids

Kentucky

"Fixed Bridge Attachments Preserving the Contact Point"
E. H. Hubbuch.....Louisville

"Treatment for Prevention of Proximal Dental Caries"
H. K. Kellogg.....Louisville

Maine

"Porcelain Restorations"
George J. Anderson.....Portland

"Orthodontia"
Albert Johnson.....Portland

Massachusetts

"Sliced Indirect Inlay Technic for the Average Dental Practice"
Leon A. Storz.....Worcester

"Orthodontia; Need of Early Diagnosis"
Fred C. Allen.....Boston

"Use of Space Retainers in Children's Dentistry"
E. F. Sullivan.....Boston

"Indirect-Direct Technic for Three-Quarter Inlay Preparation"
Walter E. Briggs.....Attleboro

Michigan

"Practical Children's Dentistry"
Samuel D. Harris.....Detroit

"Various Methods of Reducing Fractures of the Jaws"
Don C. Lyons.....Jackson

"Surgical Removal of Pulpless Teeth"
Vernor H. Eman.....Grand Rapids

"Children's Dentistry"
A. C. Thompson.....Detroit

"Oral Surgery"
Martin L. DeBats.....Detroit

"Periodontia Instruments and Their Use"
Clayton H. Gracey.....Detroit

"Gold Inlays for Deciduous Teeth"
William H. Thwaites....Grand Rapids

"Control of Variables in Waxing, Investing and Casting Technics"
Grand Rapids Clinic Club
F. J. Henry, Director
M. O. Page
E. C. Beebe
C. M. Madden
C. H. Sigtenhorst
W. M. Campbell

Minnesota

"Simplified Technic of Scaling Teeth in Pyorrhea"
D. R. Miller.....Bird Island

"Wax Expansion and Steam Elimination Technic"
F. S. Meyer.....Minneapolis

"Full Denture Technic"
H. A. Munns.....Minneapolis

"Fixed Bridgework, with Special Attention to Porcelain Tipped Pontics"
Charles Peterka .....Minneapolis

"Pontics and Broken Stress Bridgework"
R. A. Ulvestad.....Minneapolis

"Amalgam Technic"
T. C. Glanz.....Minneapolis

"Combination Modeling Compound and Plaster Technic for Full Denture Construction"
R. F. D. Johnson.....Minneapolis

"Indirect Inlay Technic"
F. A. Heiberg.....Northfield

"Thimble Bridges"
E. J. Murphy.....Minneapolis

"Amalgam Restorations from the Economic Standpoint"
H. H. Godberson.....Northfield

"Three-Quarter Crown Preparation and Castings for Anterior Bridge Construction"
L. E. Aurelius.....St. Paul

"Tooth Preparation for Bridge Abutments"
George W. Reynolds.....Minneapolis

"Anatomic Postdam Technic"
R. P. Hartig.....Minneapolis

Minneapolis Prosthetic Group
H. L. Harris, Director

"Anatomy of the Mouth"
H. L. Harris

"Upper Impression, Boxing and Pouring of Cast; Building of Biteplate, Postdamming"
V. W. Davis

"Lower Primary Impression Pouring of Cast, Anatomic Outline on Lower Cast, Building of Biteplate"
P. J. Miesen

"Rebasing Lower Denture"
C. A. Swanson

Missouri

"Occlusion—New Way of Attacking Greatest Problem in Denture Construction"
F. Hubert Eversull.....Kansas City

"Technic of Constructing Jacket Crown"
Wiley W. Brown.....Joplin

"Removable Bridgework; Replacing of Lost Teeth Distad from Cuspids; Proof that Clasps Do Not Cause Tooth Decay"
Charles P. Grosby.....St. Louis

"Inlay Technic"
F. W. Fender.....St. Louis

"Interpretation of Roentgenographic Films"
L. R. Main.....St. Louis

"Anterior Maxillary Bridge Model Showing Three Kinds of Attachments, Two Interchangeable Pontics, and Twelve Different Kinds of Bridgework"
E. H. Eden.....St. Louis

Nebraska

"Porcelain Manipulation"
L. E. Myers.....Omaha

"Porcelain Manipulation"
H. A. Merchant.....Omaha

"Dental Films in the Science of Teaching; Continuous Sequential Steps in Various Technics on Regular Motion Picture Film"
F. J. Viner.....Omaha

"Orthodontia"
Orthodontia Group—Nebraska
Arlo M. Dunn, Chairman.....Omaha
Don L. Hornbeck.....Omaha
C. E. Brown.....Lincoln
Paul J. Ludwick.....Lincoln
Howard Yost .....North Platte

"Inlays and Gold Foil" (Bureau of Standards)
W. J. Brennan.....Omaha
D. E. Conley.....Omaha
Paul Muffly .....Omaha
E. H. Bruening.....Omaha
Gladstone Derby .....Omaha
C. F. Patton.....Omaha
J. S. Schall.....Omaha
Walter Sorenson .....Omaha
E. J. Hardlannert.....Omaha
L. C. Blackman.....Fremont

"Reducing Roentgen-Ray Films"
Paul L. Deines.....Lincoln

"Practical Points Regarding Children's Teeth"
H. A. Capek.....Lincoln

"Removable Bridgework"
B. F. Schwartz.....Lincoln

"Preparing Dentures for Rebasing"
W. D. Wallace.....Lincoln

"Surgical Clinic"
F. W. Webster.....Lincoln

"Partial Denture Impressions"
C. A. Bumstead.....Lincoln

"Removable Bridgework"
W. H. Thomas.....Lincoln

"Predenture Face Records"
R. C. Groom.....Lincoln
"Oral Bacteriologic and Pathologic Specimens"
W. M. H. Jones.....Lincoln
"Case Histories"
C. F. McAdams.....Lincoln
"Demonstrating Models"
M. C. Pederson.....Lincoln

New Jersey
"Surgical Preparation of the Mouth for the Proper Fitting of Dentures"
John A. Flood.....Trenton
"Vincent's Infection and the General Practitioner"
William I. McGonigle.....Freehold
"Drugs and Their Uses"
William E. Van Eerde.....Camden

New York
"Wax Expansion Technic for Gold Inlays"
R. L. Robinson.....Buffalo
"Principles and Practice of the Utilization of Spear-Point Drill Technic in the Simple and Involved Surgery Governing the Removal of Fractured, Embedded, Exostosed, Malposed and Impacted Roots and Teeth"
M. H. Feldman.....New York City

North Carolina
"Balanced Occlusion by Three-Point Contact on Plane-Line Articulator"
L. G. Coble.....Greenboro

North Dakota
"Full Lower Impression; Rebasing with Wax; Vulcanite Trays to Hold Radium Tubes in Treatment of Cancer of Mouth"
R. A. Ogilvie.....Grand Forks
"Oral Anatomy"
H. C. Cooper.....Abercrombie
"Outline of Medication for Vincent's Infection"
L. E. Musburger.....Jamestown
"Use of Low Fusing Stain on Porcelain Teeth"
R. S. Towne.....Bismarck

Ohio
"Nitrous Oxid-Oxygen Analgesia in Dentistry, Simplified Technic"
C. C. Sullivan.....Youngstown
"Some of the Applications of a Bar Clasp Denture"
Harry L. Zeve.....Youngstown
"Minor Oral Surgery for the General Practitioner"
Reed J. Calcott, Jr.....East Liverpool
"Exodontia"
L. T. Sauerbrun.....Warren
"Cushion Dentures; Relining Dentures Without Vulcanizing"
H. D. Morgan.....Youngstown
"Construction of a Porcelain and Gold Jacket Crown Combination"
Lee W. Atkinson.....Salem
"Intra-Oral Unicontact Device for Making Gothic Arch Tracing and Registering Occlusion"
L. L. Sheffield.....Toledo
"Stress-Breakers for Small-Span Fixed Bridges"
Robert P. Dressel.....Cleveland

Oregon
"Diversified Operative Technic"
John Kuratli.....Portland
"Experimental Work in Animal Inoculation in Connection with Cases of Chronic Dental Infection"
W. Claude Adams.....Portland
"Recording Positional Occlusion Registrations Essential to Functional Occlusion of Full Dentures"
David T. Chase.....Portland
"Porcelain Bridgework"
D. D. Fisher.....Portland
"Gold Foil; Cavity Preparation in Plaster Models; Fillings in Extracted Teeth That Were Inserted Before and After Extraction"
Portland Dental Study Club
T. C. Bailey
Neil M. Bain
T. S. Dulin
Donald G. Hood
W. A. Johnson
M. A. Milne
Arthur G. Rossman
William E. Snook
C. M. Wheeler
G. A. Woods

Pennsylvania
"Root Removal"
Guy L. Haman.....Reading
"Displacement of Fractured Roots"
Fred D. Miller.....Altoona

South Carolina

"Amalgam Technic"
Virgil B. Hawkins.....Union

Tennessee

"Direct Band Technic" (Moving picture)
O. A. Oliver.....Nashville

"Porcelain Jacket Technic" (Moving picture)
Fred H. Hall.....Nashville

"Pyorrhea Operation" (Moving picture)
Carl W. Hoffer.....Nashville

"Quickly Made Accurate Fitting Indirect-Direct Inlays and Bridge Abutments, Using a Simple Expansion Method for Controlling Shrinkage"
T. E. Braley.....Chattanooga

Utah

"Removal of Mandibular Third Molars"
W. S. Paine.....Ogden

"Cast Gold Inlays and Bridge Attachments"
Salt Lake City Group
William Wood
D. A. Jones

Washington

"Impression Technic for Full and Partial Artificial Dentures"
H. C. Houck.....Seattle

"Common Sense in Oral Home Care"
Harold S. Burkhart.....Seattle

West Virginia

"The Handling of Children with Acutely Abscessed Teeth"
L. A. Stark.....Clarksburg

Wisconsin

"Stereoscopic Dental Roentgenograms"
Florian J. Martin.....Medford

"Porcelain and Its Practical Application to Dentistry"
H. M. Uebele.....Milwaukee

"Cast Crowns Versus Inlays as Molar Abutments"
George A. Stratton.....Oshkosh

"Specific Treatment for Vincent's Infection"
T. A. Hardgrove.....Fond du Lac

GROUP 4: TWELFTH DISTRICT CLINIC PROGRAM

"Children's Dentistry"
R. C. Meyer.....Okmulgee, Okla.

"Children's Dentistry—Building Versus Repairing"
Norman A. Scism.....Walters, Okla.

"Cervical Cavity Impression Technic, Indirect"
G. A. Roelke.....Tulsa, Okla.

"Protecting Natural Teeth and Gold Restorations from Attrition Caused by Artificial Dentures"
G. L. Tetrick.....Manhattan, Kan.

"Cavity Preparation in Anterior Teeth for Gold Inlays and Synthetic Porcelain"
L. A. Rawlins.....Liberal, Kan.

"Children's Dentistry—Procedures and Conditions"
Oren V. Shaw...Colorado Springs, Colo.

"Amalgam"
J. D. Royce.....Boulder, Colo.

"Cavity Preparation"
E. G. Netherton.....Denver, Colo.

"Possibilities in Root-Canal Work"
M. A. Gates.....Fort Collins, Colo.

"Pulp Stones"
Earl W. Spencer.....Pueblo, Colo.

"Amalgam"
J. G. Ewers.....Denver, Colo.

"Gold Foil"
F. A. Peterson.....Denver, Colo.

"Root-Canal Technic"
B. A. Murray.....Denver, Colo.

"Gold Foil Fillings for Pits and Fissure Cavities"
George H. Mengel.....El Paso, Texas

"Correcting Impressions for Three-Quarter Crowns and Inlays"
A. M. Bradley.....Muskogee, Okla.

"Wax Impression Technic for Inlays with Double Sprue"
A. F. Sebert.....Clinton, Okla.

"Construction of a Full Cast Crown"
William E. Overmyer....Muskogee, Okla.

"Splint for Multiple Fracture of the Mandible"
J. F. Nelson.....Parsons, Kan.

"Simple and Practical Technic in Inlay and Abutment Work Which Saves Time and Insures Good Margins"
W. Graves Peay.....Little Rock, Ark.

"Bridgework and Inlays"
A. B. Crutcher.....Dallas, Texas

"Casting to Dimensions" (Moving picture)
W. A. Grouws.....Dallas, Texas

"Porcelain Jacket Crowns Made from Detached Post Crowns Without the Use of Furnace or Baked Porcelain"
J. P. Arnold.....Houston, Texas

"Simple Fixed Bridge Attachments"
Thomas J. Pearson.....Roswell, N. M.

"Manipulation of Copper Amalgam in Making Dies for Indirect Inlay Work"
E. E. Ramsey.....Topeka, Kan.

"Removable Bridge Attachments"
E. E. Welch.....Topeka, Kan.

"Fixed Bridgework with Special Attention to Porcelain Pontics"
J. B. Stevens.....Hutchinson, Kan.

"Indirect Inlays and Bridge Abutments"
N. C. Gunter.....Pueblo, Colo.

"Anterior Bridge Showing Pinledge and Thimble Porcelain Jacket Crown"
A. F. Hatch.....Denver, Colo.

"Inlays and Bridgework"
E. W. Ross.....Garden City, Kan.

"Opening the Checkbite to Restore Normal Function"
W. B. Dorman.....Nashville, Ark.

"Porcelain Art"
W. A. Warwick.....Tulsa, Okla.

"Dental Ceramics"
H. E. Rice.....Colorado Springs, Colo.

"Impressions of Edentulous Mouths"
J. B. Herring.....Oklahoma City, Okla.

"Full Dentures; Plaster Checkbite Centric Relation; Anatomic Articulator; Grinding to Instead of Away from Centric Occlusion"
G. W. Andree.....Tishomingo, Okla.

"Method of Placing Wires in Fractures"
A. C. Sloan.....Dallas, Texas

"Technic of Exactly Reproducing the Trying In with Thin Rubber Denture"
Claude A. Northcutt...Ponca City, Okla.

"Simplicity of Making Records and Articulator Adjustments"
B. F. Thielen.....Paris, Texas

"Registering Centric Occlusion; Protrusive Checkbite Technic and Face-Bow Mounting"
Birch L. McCoy.....San Antonio, Texas

"Molding of Dentures from Synthetic Plastics —Celluloid, Hecolite, Alcolite, Naturalite, Etc., by the Dry Heat Process, with Special Press and Flask"
Russell Markwell .....Galveston, Texas

"Full Denture with Patient in Chair"
H. J. Warta.....Loveland, Colo.
Arthur A. Drew.....Loveland, Colo.

"Possibilities for Surgery in General Practitioner's Office in Relation to Immediate Replacements"
Ralph R. Gibson.....Denver, Colo.

"Centric Occlusion Secured When Impressions Are Made"
Albert J. Bock.....Macksville, Kan.

"Full Denture Technic"
A. H. Brown.....Denver, Colo.

"Full Denture Construction Considering Mouth Anatomy and Impression Taking"
Ralph L. Christy.....Denver, Colo.
Fred J. Swisher.....Denver, Colo.
L. Glenn Cody.....Denver, Colo.

"Grinding and Waxing Tube Teeth to Occlusion"
Charles A. Eller....Albuquerque, N. M.

"Impactions; Models Showing Treatment and Bone Development"
T. M. Robertson.....Coffeyville, Kan.

"Wax Models of Practical Cases in Dental Oral Surgery"
W. W. Cogswell.....
.....Colorado Springs, Colo.

"Technic for Removing Impacted Maxillary Cuspid" (Moving picture)
John W. Seybold.....Denver, Colo.

"Technic for the Surgical Removal of Teeth, Including Impacted Third Molar" (Moving picture)
W. M. McCall.....Temple, Texas

"Surgical Removal of Teeth that Present Difficulties in Extraction, with Minimum Loss of Bone."
David M. Prowell.....New Orleans, La.

"Two Badly Misplaced Upper Third Molars" (Demonstration with human skull and roentgenogram)
T. J. Geren.....Groesbeck, Texas

"Dental Roentgen-Ray Stereoscopy"
Edward P. Cressler.....Newton, Kan.

"Method of Making Bite-Wing Film Packets"
L. M. Fleisch.....Topeka, Kan.

"Roentgen-Ray Studies of Skull and Facial Bones"
William F. Drea.Colorado Springs, Colo.

"Roentgen Rays"
David A. Block.....Denver, Colo.

"Roentgenographic Diagnosis"
George R. Warner.....Denver, Colo.

"Cross-Checking Impactions"
J. T. Edwards.....Fort Worth, Texas

"Roentgenographic Studies"
Ira C. Brownlie.....Denver, Colo.

"Roentgen-Ray Films Showing Development of Sinus"
T. E. Carmody.....Denver, Colo.

"Vincent's Infection"
Rowe Smith .....Texarkana, Ark.

"Trauma"
S. B. Riggs.....San Antonio, Texas

"Some Improvements Following Periodontal Treatment; Both Local and Systemic"
L. A. Neil.....El Paso, Texas

"Traumatic Occlusion"
Hugh D. Wilson.....Topeka, Kan.

"Tuberculosis—Mouth Infection"
C. S. Kramer.....Woodman, Colo.
P. K. Steahlin.....Woodman, Colo.

"Gum Resection in Periodontoclasia"
A. C. Hamm.....Denver, Colo.

"Orthodontia"
W. P. Delafield.....Dallas, Texas

"Value of Roentgenographic Diagnosis in Orthodontia"
George L. Turner.....Wichita, Kan.

"Diagnosis of Acromegaly, Potential Acromegaly and Types That May be Erroneously Diagnosed as Such"
Homer B. Robison.....Hutchinson, Kan.

"Orthodontia"
Floyd A. Nelson.....Clay Center, Kan.

"Space Maintainers"
Frederick P. Wells.....
.....Colorado Springs, Colo.

"Preventive Orthodontia"
A. H. Ketcham.....Denver, Colo.
William R. Humphrey....Denver, Colo.
Harry V. Banks.....Denver, Colo.
George F. Bowden.....Denver, Colo.

"Easy Prevention of Malocclusion of Permanent Teeth, Due to the Premature Extraction of Deciduous Teeth"
Leo J. Schoeny.....Donaldsonville, La.

"Giving Dental Patients a Dietary Foundation"
Henry F. Hoffman.....Denver, Colo.

"Mouth Hygiene Program in Texas, Showing Slides, Posters and Charts"
G. H. Ater.....Lubbock, Texas

"Subject of Diet"
Leon R. Kramer.....Hanover, Kan.

"Educational Models"
Arthur W. Grove.....Okmulgee, Okla.

"Progress"
M. H. Gray.....Little Rock, Ark.

Group Clinic
G. V. Black Study Club....Denver, Colo.
Colorado Prosthetic Club..Denver, Colo.

"Examination and Diagnosis"
G. I. Lininger
James A. Skipp
F. J. Brady
A. G. Clarke

"Study Casts"
T. D. Grannick
J. J. Saphro
George Jackson
E. N. McDowell

"Engineering—Design"
W. O. Brubaker
A. E. Cuaz
F. E. Hayano

"Esthetics"
R. J. Glesen
Edwina W. Hedge

"Economics"
Fred L. Scott
H. G. Wiggins
W. L. Ginsburg
R. H. McBride

"Impressions and Casts"
H. J. French
E. T. Glessner
W. F. Setzler
J. T. Williams

"Waxing and Investing"
A. C. Grimm
J. L. Smith
George W. Hoffman
Daniel Bate

"Burning Out, Casting and Finishing"
F. D. Burns
A. C. Dewsberry
Anna M. Buell
A. A. Kahan

"Finished Case in Patient's Mouth"
L. W. Johnston.....Denver, Colo.

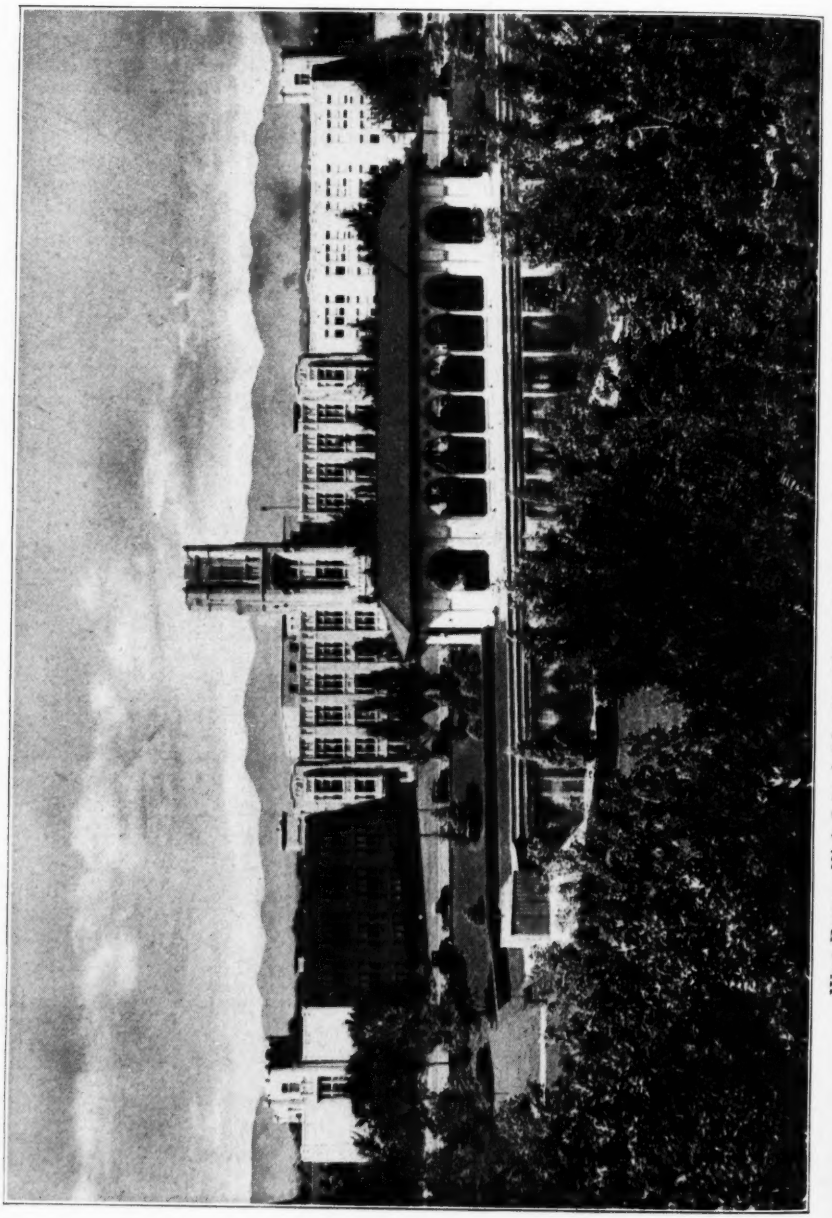
"Preparation and Technic of the Cast Fixed Bridge Abutment"
E. F. Arnold
H. R. Sydenham

"Compound-Paraffin Impression Technic"
K. R. Fulton

"Anatomic Reproduction in Cast Gold Crowns"
George G. Ingham.....Amarillo, Texas

"Transferring Bite Rims from Mouth to Articulator and Boxing and Pouring Models"
W. R. Moody.....Amarillo, Texas

Colorado State Capitol Building from Civic Center, Denver, Colo.



West Denver High School, Meeting Place of the Seventy-Second Annual Session of the American Dental Association, Denver, Colo., July 21-25, 1930.

THE DENVER SESSION

LUNCHEON CLUB PROGRAM

Tuesday, July 22

Lions Club of Denver, Albany Hotel, 12:15 p. m., F. Blaine Rhobotham, Chicago, Ill., speaker.

Wednesday, July 23

Civitan, Brown Palace Hotel, 12:15 p. m., Arthur H. Merritt, New York City, speaker.

High Twelve Club, Brown Palace Hotel, 12:15 p. m., Roy J. Rinehart, Kansas City, Mo., speaker.

Kiwanis, Albany Hotel, 12:15 p. m., John P. Buckley, Hollywood, Calif., speaker.

Universal, Denver Dry Goods Tea Room, 12:15 p. m., Guy S. Millberry, San Francisco, Calif., speaker.

Thursday, July 24

Cooperative, Brown Palace Hotel, 12:15 p. m., C. N. Johnson, Chicago, Ill., speaker.

Exchange, Cosmopolitan Hotel, 12:15 p. m., W. H. G. Logan, Chicago, Ill., speaker.

Optimist, Albany Hotel, 12:15 p. m., E. L. Pettibone, Cleveland, Ohio, speaker.

Rotary, Cosmopolitan Hotel, 12:15 p. m., Donald McKay Gallie, Chicago, Ill., speaker.

RADIO PROGRAM

Tuesday, July 22

KOA (NBC).
KLZ (Columbia).
KFEL.

Wednesday, July 23.

KOA (NBC).
KLZ (Columbia).
KFEL.
KFXF.

Thursday, July 24

KOA (NBC).
KLZ (Columbia).
KFEL.
KFXF.

ANNOUNCEMENTS

PAST PRESIDENTS' (A. D. A.) CLUB LUNCHEON

The luncheon for the Past Presidents' Club of the American Dental Association will be held Tuesday, July 22, at 12:30 p. m., at the Brown Palace Hotel. Roscoe H. Volland, Iowa City, Iowa, will preside, and Homer C. Brown, Columbus, Ohio, will make the annual address.

MOUTH HYGIENE LUNCHEON

The annual Mouth Hygiene Luncheon of the American Dental Association will be held Wednesday, July 23, at 12:15 p. m., in the Venetian Room of the Shirley-Savoy Hotel. A feature of the luncheon will be a playlet, the "Sells-Health-O Circus," written by Lon W. Morrey of the Chicago Department of Health and presented by the Denver school children. The tickets for the luncheon will be $1.50 each.

COLORADO STATE DENTAL SOCIETY LUNCHEON

A luncheon will be given to the Officers and Delegates of the American Dental Association by the Colorado State Dental Society, Monday, July 21, at 12:30 p. m., at the Brown Palace Hotel, Denver.

ASSOCIATION OF AMERICAN WOMEN DENTISTS

The ninth annual meeting of the Association of American Women Dentists will be held at the Olin Hotel, Denver, July 21.

MILDRED W. DICKERSON, *President*
WILHELMINA YERETSKY, *Sec'y-Treas.*
26 Sheldon Avenue, S. E.,
Grand Rapids, Mich.

ASSOCIATION OF MILITARY DENTAL SURGEONS

The annual meeting of the Association of Military Dental Surgeons will be held Wednesday, July 22.

R. L. ROBINSON, *President*
WILLIAM H. SQUIRES, *Chairman*
Local Arrangements Committee,
Fitzsimmons General Hospital,
Denver, Colo.

NATIONAL ASSOCIATION OF DENTAL EXAMINERS

The National Association of Dental Examiners will hold its forty-eighth annual convention at the Brown Palace Hotel, Denver, beginning Monday morning, July 21, at 9 o'clock, and continuing through July 22. This meeting will be one of unusual importance in view of the fact that many matters of

West Denver High School, Meeting Place of the Seventy-Second Annual Session of the American Dental Association, Denver, Colo., July 21-25, 1930.

national, state and interstate application are to be considered and acted on. Each board of dental examiners in the United States is expected to participate in the proceedings of this meeting, since each state will be vitally concerned as to the disposition of matters to be worked out at the Denver sessions. The officers of this organization are W. S. P. Combs, president, Middletown, Del.; George S. Vann, vice-president, Gadsden, Ala.; John S. Parkhurst, vice-president, Humboldt, Kan.; C. Williard Camalier, vice-president, Washington, D. C.; George L. Powers, secretary-treasurer, Memphis, Tenn.

GEORGE L. POWERS.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

The twelfth annual meeting of the American Society of Oral Surgeons and Exodontists will be held July 18-19, at the Troutdale Hotel, "Troutdale-in-the-Pines," Evergreen, Colo., thirty miles from Denver. It will be necessary to make reservations at the Troutdale Hotel for this meeting and reservations in Denver for the meeting of the American Dental Association.

A. L. FREW, *Secretary*
4105 Live Oak St.,
Dallas, Texas.

AMERICAN ACADEMY OF PERIODONTOLOGY

The seventeenth annual meeting of the American Academy of Periodontology will be held at the Acacia Hotel, Colorado Springs, Colo., July 17-19.

CLYDE C. SHERWOOD, *President*
CLAYTON H. GRACEY, *Sec'y-Treas.*
269 Rowena St.,
Detroit, Mich.

AMERICAN ACADEMY OF RESTORATIVE DENTISTRY

The third annual meeting of the American Academy of Restorative Dentistry will be held at the Broadmoor Hotel, Colorado Springs, Colo., Friday and Saturday, July 18-19.

THEODORE W. MAVES, *President*
624 Hanna Bldg.,
Cleveland, Ohio.

AMERICAN SOCIETY FOR THE PROMOTION OF CHILDREN'S DENTISTRY

The fourth annual business luncheon of the American Society for the Promotion of Children's Dentistry will be held at the Brown Palace Hotel, Thursday, July 24, at 12:15 p. m. All members of the American Dental Association are invited.

JOHN E. GURLEY, *President*
SAMUEL D. HARRIS, *Secretary*
2002 Eaton Tower,
Detroit, Mich.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

The seventh annual meeting of the American Dental Hygienists' Association will be held in Denver, July 21-25. The Colorado State Dental Hygienists' Association has extended an invitation to all the members to meet in Denver. The Colburn will be headquarters.

AGNES G. MORRIS, *Secretary*
886 Main St.,
Bridgeport, Conn.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

The American Dental Assistants Association will hold its sixth annual meeting in Denver, July 21-25. The Mayflower Hotel, 1710 Grant St., will be general headquarters. Prominent members of the dental profession will address the various sessions and papers will be read by members of the association. Table clinics exemplifying the work of the dental assistants will be presented on Wednesday afternoon, July 23. Special features of the convention will include a district luncheon, a conference luncheon for officers of the constituent societies, a class in parliamentary procedure conducted by Juliette A. Southard, president, and a banquet to be held on Wednesday evening, July 23, at 7 o'clock. All meetings and the banquet will be held at the Shirley-Savoy. Convention arrangements are in charge of Miss Aloise B. Clement, 310 Omaha B. and L. Assn. Bldg., Omaha, Nebr. Special arrangements have been made for group reservations with the B. and O. Railroad from New York to Chicago, and with the Chicago and Northwestern and Union Pacific railroads from Chicago to Denver. Members of the dental profession are invited to attend the sessions, the clinics and the banquet. Dental assistants

are urged to plan a week of their vacations for convention time. For further information, address the general secretary, Ruth F. Rogers, Suite 803, 223 W. Jackson Blvd., Chicago, Ill.

JULIETTE A. SOUTHARD, *President*
174 West 96th St.,
New York City

WOMEN'S AUXILIARY OF THE AMERICAN DENTAL ASSOCIATION

The annual business meeting of the Women's Auxiliary of the American Dental Association will be held Monday, July 21, at the Cosmopolitan Hotel. The wives of all A. D. A. members are invited to join this organization. Annual dues are one dollar, payable to the treasurer, Mrs. Alexander H. Reynolds, 4630 Chester Avenue, West Philadelphia, Pa. At 1 p. m. Monday an "Acquaintance Luncheon" will be given under the auspices of the Women's Auxiliary, in the Arabian Room of the Cosmopolitan Hotel, at one dollar a plate. Make reservations through Mrs. Henry F. Hoffman, 700 Majestic Building, Denver. On Tuesday, July 22, at 9:30 a. m., a sightseeing tour of the city will be made in private automobiles, under the auspices of the Ladies Guest Club of the Colorado State Dental Association. Those desiring to take the trip will be called for at the Brown, Cosmopolitan and Shirley-Savoy Hotels. On Wednesday, July 23, a tour of the mountain parks will be made, with luncheon at Troutdale-in-the-Pines. The ladies' parlor at the Convention Hall will be open at all times, members of the Guest Club acting as hostesses. There will be hostesses at the three headquarters hotels, Brown, Cosmopolitan and Shirley-Savoy.

AMERICAN DENTAL TRAP SHOOTERS LEAGUE

The American Dental Trap Shooters League will hold its eighth annual shoot at the Denver Municipal Traps during the week beginning July 20. Participants shall be members in good standing of the American Dental Association and the American Dental Trap Shooters League. Two valuable trophies are now in possession of the American Dental Trap Shooters League. These two trophies shall be won three times before they become the property of the holder. They go to the winner of first place each year with the understanding that he return them at the next annual meet, unless he has won them three times. The contest will be 100 targets at 16 yards, four events of twenty-five each. A state team race will be held, known as the five-man team. Any state may enter five or more shooters, five high scores to count. Each member of the winning team will receive a trophy. This will be shot in the regular one hundred program. The Local Committee of the Trap Shooters League expects to provide a trophy or souvenir for all the shooters attending. The traps are fifteen minutes from Denver. Take Larimer Street Car, Route Number 61 west, or drive west on Colfax to Yates Street and go north two blocks. Monday, July 21, 1 p. m., will be the time. The Denver Municipal Trap Club has nine available traps in perfect condition. Through their cooperation and to aid in the speedy execution of the event, there will be twelve men to man the traps, four score keepers, and two cashiers. Ammunition and targets will be furnished at the club to members at cost. Owing to the clearness of our mile high atmosphere and one of the best backgrounds in the country, we anticipate from 5 to 10 per cent better scores than usual from all contestants. Our club house on the shore of Sloan's Lake has a wonderful view of the mountains and of the city.

E. J. BOYD, *Chairman*
104 Broadway,
Denver, Colo.

AMERICAN DENTAL GOLF ASSOCIATION

Five well-turfed, well-kept private courses, all within fifteen minutes of the hotel district, will be at the disposal of A. D. A. golfers during the convention. Denver also has two municipal courses in the city and one in the mountains. For those wishing to spend the week-end at Colorado Springs, the well-known and difficult Broadmoor course at the foot of Pikes Peak is available. This course will be the scene of the Trans-Mississippi Golf Association's Tournament, June 23-28, one of the best tournaments in the country. The Denver Invitation and City Championship Tournament will be held at the Wellshire Country Club, Denver, July 24-27. Many dentists are expected to play in this event. The American Dental Golf Association annual tournament will be held Monday, July 21. Play will be over three courses. Class A at Cherry Hills; Class B at Lake-

wood; Class C at Wellshire. There will be many events in all these classes and plenty of prizes for the winners. The courses will be open for practice the week previous to the tournament with the exception of Saturday afternoon and Sunday morning. The annual banquet and Calcutta Pool will be held Sunday evening, July 20, on top of Lookout Mountain. A barbecue dinner will be served in true western style. If you are not a member of the American Dental Golf Association, communicate immediately with E. W. Browning, Boston Bldg., Salt Lake City, Utah. The Committee on Golf places Denver's and Colorado's golfing facilities at your disposal.

E. E. BAILEY, *Local Chairman*
1124 Republic Bldg.,
Denver, Colo.

DELTA SIGMA DELTA FRATERNITY

The forty-sixth annual meeting of the Supreme Chapter of Delta Sigma Delta Fraternity will be held in Denver, Monday, July 21. The first session will be held at 9:30 a. m.; the afternoon session will convene immediately after luncheon. Initiatory exercises will be held during the afternoon session. The business meetings and initiatory exercises will take place in the Auditorium of the Continental Oil Building. The Bureau of Registration will be found in the Cosmopolitan Hotel, where the annual banquet will be held at 6 p. m. When registering for the banquet, please present membership card to the committee having that matter in charge. Those expecting to attend should get in touch with Brother Theodore D. Grannick, Grand Master of Denver Auxiliary Chapter, 533 Republic Building, Denver, Colo.

By order of the Supreme Chapter.

RALPH R. BYRNES, *Supreme Grand Master*
R. HAMILL D. SWING, *Supreme Scribe.*

XI PSI PHI FRATERNITY

Xi Psi Phi annual banquet will be held Monday, July 21, at 6 p. m., at the Albany Hotel, headquarters. All members of the fraternity and their wives are cordially invited to be present.

G. A. GRUBB, *Supreme President*
302 Andrews Hall,
Lincoln, Nebr.

PSI OMEGA FRATERNITY NATIONAL ALUMNI CHAPTERS

Headquarters of the National Alumni Chapter of Psi Omega will be the Adams Hotel, Denver. The annual Round-Up banquet will be held Monday, July 21 at 6:30 p. m. Members may bring women guests. The executive meeting of the chapter together with initiations will occur at the headquarters, Tuesday, July 22, at 2 p. m.

JAMES A. BLUE, *Grand Master*
Empire Building,
Birmingham, Ala.

H. B. MCCARTHY, *Secretary*
Medical Arts Building,
Baltimore, Md.

DIRECTORY OF COMMERCIAL EXHIBITORS

Abbott Laboratories, 14th St. and Sheridan Rd., North Chicago, Ill.

Aderer, Julius, Inc., 115 W. 45th St., New York City.

American Hecolite Denture Corporation, 94 E. 6th St., Portland, Ore.

Ames, The W. V-B, Company, Fremont, Ohio.

Ash, Claudius, Sons & Co., U. S. A., Inc., 127 Coit St., Irvington, N. J.

Bayer Company, Inc., The, 117 Hudson St., New York City.

Beirsdorf, P., & Co., Inc., 122 Hudson St., New York City.

Berry Dental Laboratory Company, The, 409 N. 11th St., St. Louis, Mo.

BiSoDol Company, The, 130 Bristol St., New Haven, Conn.

Blaurock, Carl, 522 Mack Building, Denver, Colo.

Boos, Henry P., 608 Nicollet Ave., Minneapolis, Minn.

Bosworth, Harry J., Co., 341 E. Ohio St., Chicago, Ill.

Bristol-Myers Company, 75 West St., New York City.

Buck X-Ograph Company, 6629 Olive St., St. Louis, Mo.

Burdick Corporation, The, Milton, Wis.

Butler, John O., Company, 7359 Cottage Grove Ave., Chicago, Ill.

Cameron's Surgical Specialty Co., 666 W. Division St., Chicago, Ill.

Chicago X-Ray Film & Mount Company, 4912 Lincoln Ave., Chicago, Ill.

Colgate-Palmolive-Peet Company, Palmolive Building, Chicago, Ill.

Columbia Dental & X-Ray Corp., 131 E. 23rd St., New York City.

Corega Chemical Company, 208 St. Clair Ave., Cleveland, Ohio.

Corning Rubber Co., Inc., 266 Pearl St., Brooklyn, New York.

Crescent Dental Mfg. Co., 1839 S. Crawford Ave., Chicago, Ill.

Dee, Thomas J., & Company, 55 E. Washington St., Chicago, Ill.

Dental Specialty Company, 1638 California St., Denver, Colo.

Dentocoll Information Bureau, 475 Fifth Ave., New York City.

DeVilbiss Manufacturing Company, The, 300 Phillips Ave., Toledo, Ohio.

Drucker, August E., Co., 2226 Bush St., San Francisco, Calif.

Eastman Kodak Company, 343 State St., Rochester, N. Y.

Enamodent Laboratories, Inc., 421 E. Washington St., Portland, Ore.

Flossy Dental Manufacturing Co., 825 University Place, Evanston, Ill.

Foregger Company, Inc., The, 47 W. 42nd St., New York City.

Friedman Specialty Co., 25 E. Washington St., Chicago, Ill.

Garhart Dental Specialty Co., Hill Building, Union Sq., Boston, Mass.

Goldsmith Bros. Smelting & Refining Co., 29 E. Madison St., Chicago, Ill.

Grant Dental Mfg. Co., 403 Baltimore West, Detroit, Mich.

Hanau Engineering Co., 951 W. Ferry St., Buffalo, N. Y.

Health Products Corporation, 113 N. 13th St., Newark, N. J.

Heidbrink, Company, The, 2633 Fourth Ave., Minneapolis, Minn.

Hoffman-LaRoche, Inc., 17 Cliff St., New York City.

Horlick's Malted Milk Corp., Racine, Wis.

Hu-Friedy Mfg. Co., The, 3118 N. Rockwell St., Chicago, Ill.

Interstate Electric Co., 4339 Duncan Ave., St. Louis, Mo.

Ideal Tooth Incorporated, 90 Hamilton St., Cambridge, Mass.

Iteco Company, The, 501 Morgan Building, Portland, Ore.

Johnson & Johnson, New Brunswick, N. J.

Kolynos Company, The, 130 Bristol St., New Haven, Conn.

Landberg, Henry G., Sales Co., 174 W. 3rd St., St. Paul, Minn.

Lavoris Chemical Company, 918 N. Third St., Minneapolis, Minn.

Lea & Febiger, 600 S. Washington Sq., Philadelphia, Pa.

McIntosh Electrical Corp., 233 N. California Ave., Chicago, Ill.

Merrell, Wm. S., Company, The, 5th and Pike Sts., Cincinnati, Ohio.

Minimax Company, The, 185 N. Wabash Ave., Chicago, Ill.

Mizzy, Incorporated, 105 E. 16th St., New York City.

Mosby, C. V., Company, The, St. Louis, Mo.

National Aniline & Chemical Co., Inc., 40 Rector St., New York City.

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Oral Hygiene Publications, 1117 Wolfendale Rd., Pittsburgh, Pa.

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Pycopé, Inc., Keystone Building, Joplin, Mo.

Sharp & Dohme, Baltimore, Md.

Silv-O-Dent Company, The, 17th and Alberta Sts., Portland, Ore.

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Spyco Smelting & Refining Co., 51 S. 3rd St., Minneapolis, Minn.

Squibb, E. R., & Sons, 80 Beekman St., New York City.

Stern, I., & Company, 218 West 40th St., New York City.

Surgident Company, Professional Building, Los Angeles, Calif.

Thompson's, Dr., Sterile Tooth Brush Co., 714 St. Clair St., Toledo, Ohio.

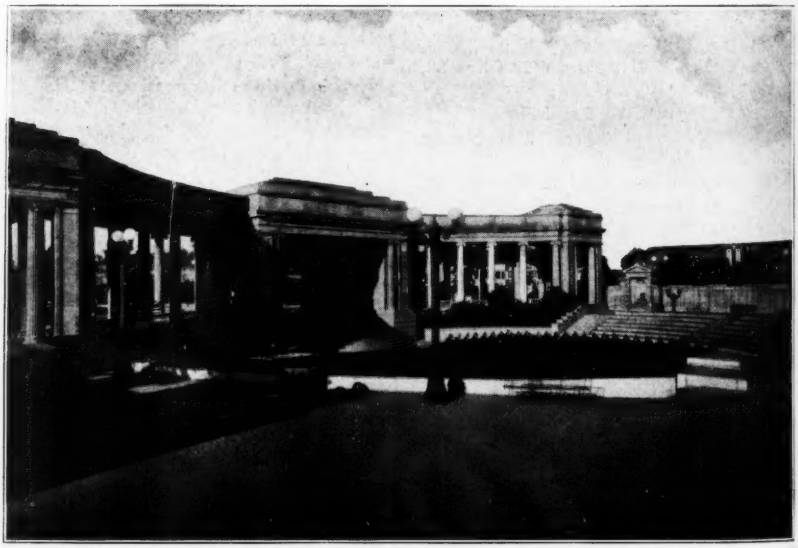
McKesson Appliance Co., 2228 Ashland Ave., Toledo, Ohio.

Vernon-Benshoff Co., 1707 Clark Building, Pittsburgh, Pa.

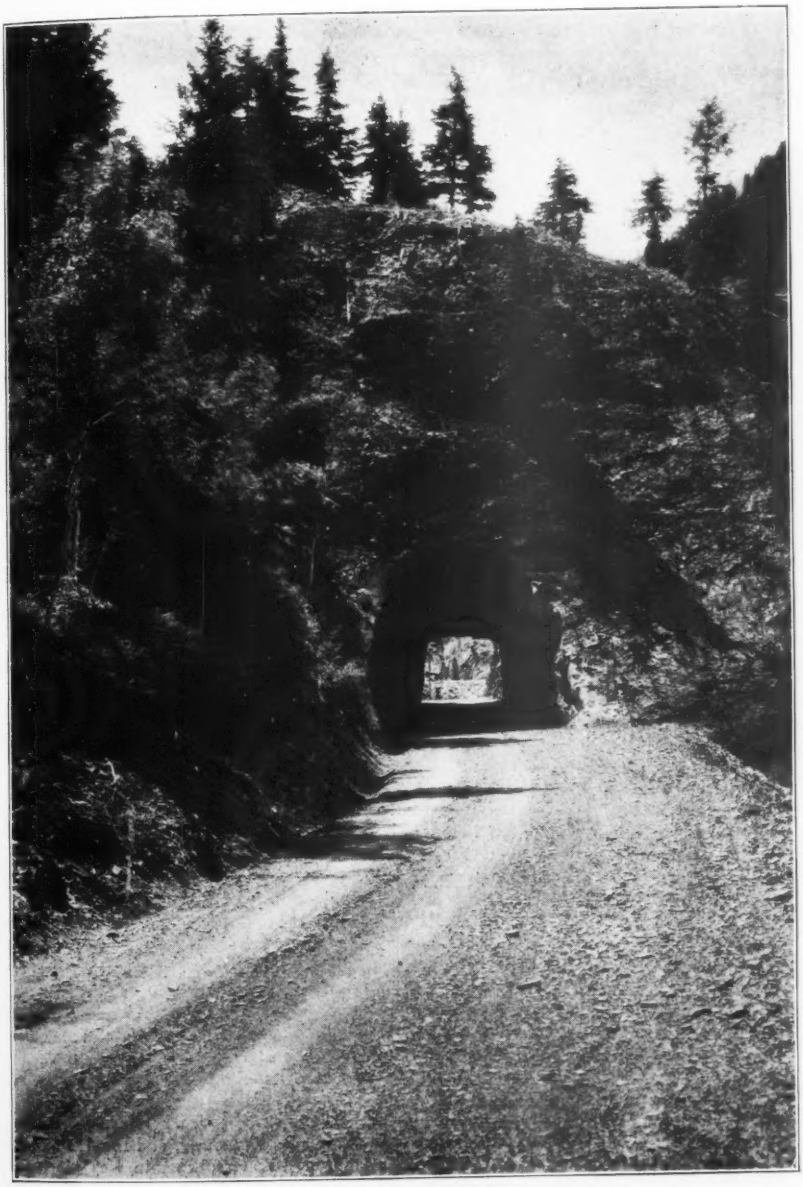
Weber Dental Mfg. Co., The, Canton, Ohio.

Wernet Dental Mfg. Co., 110 Beekman St., New York City.

Wilkinson Company, The, 1547 Fourth St., Santa Monica, Calif.



Greek Theater (seating capacity, 5,000) in Civic Center, Denver, Colo.



Tunnel, Ouray-Silverton Highway, Colorado

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Prevention of Deformities in Chronic Arthritis: In a second article under this title, Swaim and Kuhns (*J. A. M. A.*, April 12, 1930) discuss conditions affecting the spine and the head. Under "Head," they state: "Involvement of the temporomandibular joint occurs in a large number of arthritic cases. It most often produces a moderate limitation of motion on one or both sides. In the acute stages, a many-tailed jaw bandage is helpful. At the same time, the patient should have a diet that necessitates little mastication. When the soreness has passed, the ordinary use of the joint in the chewing of food will usually prevent further limitation of motion. A certain amount of correction can be secured by the use of soft wood wedges between the upper and lower teeth. Various operative procedures have been devised for securing motion when the joint is ankylosed. Associated with limitation of motion in the temporomandibular joint, but sometimes occurring independently, is a malocclusion of the teeth due to the changes in the maxillary joint. Its prevention is treatment of the joint with rest in the acute stages. The malocclusion is a dental problem."

Fusion of Teeth: Lillicrap (*Brit. Dent. J.*, April 1, 1930) reports a case of fusion of the teeth in a patient, aged about 35. In 1917, only the upper left first molar was present in the molar region. The second molar erupted one cusp subsequent to lancing and remained impacted against the first molar until 1925, when the latter tooth was extracted. In 1926, the second molar erupted farther, and there was tenderness in the region of the third molar, which appeared in 1927 and, after considerable inflammation, erupted fully in August, 1929. In January, 1930, and interstitial cavity in the third molar and the fact that it was acutely sensitive led to its extraction under nitrous oxid-oxygen. The second molar came with it. There was complete fusion of the roots of the third molar with the palatine root of the second, the latter having been rotated. Roentgenograms taken in 1925 gave no hint as to the condition.

Repair of Cleft Palates After Unsuccessful Operations: Padgett (*Arch. Surg.*, March, 1930; abstr. *J. A. M. A.*) reports cases in which he made use of a pedicled flap from the posterior pharyngeal wall in order to lengthen somewhat the short velum without narrowing the nasopharynx or oropharynx sufficiently to interfere with the function of breathing or swallowing. The method is said to be particularly applicable to those cases in which a considerable part of the velum has sloughed. For the repair of the palate in which most of the tissues of both the hard and the soft palate have sloughed, a pedicled flap of skin and subcutaneous tissue from the arm or neck was used.

Treatment of Presumably Syphilitic Child by Maternal Therapy During Lactation: Campbell and Frost (*California and West. Med.*, April, 1930) report the case of a woman, aged 40, who had had syphilis for twenty-one years, with irregular periods of treatment. She had had two husbands, from the first of whom she had contracted the disease. When she came in for treatment, she was in the eighth month of her eighth pregnancy, having had four miscarriages, one full-term hydrocephalic infant which lived twenty-four hours and two full-term children, who were now living, aged 16 and 7 years, and both syphilitic. She sought medical aid because she was "frightened for the child because the two other children got sick after they were born, and there was something wrong with their teeth." Intramuscular injections of salicylate of mercury, 1 grain, were given her at weekly intervals, and one month after she was first seen, an apparently healthy child was born. Neoarsphenamin was given her for nine months thereafter intravenously, and for five months thereafter, sulpharsphenamin was given intramuscularly at weekly intervals. The baby

was then weaned. The child's serologic reaction was consistently negative. At 2 years, she is apparently normal in every way, and has continued to develop and progress normally since birth. The author discusses the opinions of various writers concerning the use of direct and indirect medication and the advisability of treating the potentially syphilitic child who is apparently normal.

Cancer of Lip and Buccal Mucous Membrane: Lesions in this field are probably harder to deal with successfully than any others because, as in cases within the buccal cavity, the areas are bathed with saliva, and are irritated constantly by the tongue, and immobility is virtually impossible on account of the activity of the facial muscles (William D. James, in *Am. J. Surg.*, March 1930). In these cases, the condition is very refractory to treatment by surgery, roentgen rays and radium. Surgery was formerly the operation of choice, the fat and glands of the submental and submaxillary regions being removed to avoid tendency to metastasis. It has been the author's experience that radium and roentgen-ray therapy are not at all satisfactory in these cases, except in the case of a growth on the lip far enough removed from the mucocutaneous junction that it is not kept moist by the saliva. Electrocoagulation is the operation used, the area being blocked with a 1 per cent solution of procain. The operating electrode is inserted well beyond the base of the lesion. The author says: "In the removal of a cancer of the lip, the electrode is first inserted from the external aspect for a distance of about two-thirds of the way through the lip, in a crescentric line about the cancer and at a distance of one-half inch from it. Then the lip is everted and a like procedure on the inside of the lip is carried out. If the cancer is within the mouth, for example on the inside of the cheek, the same procedure is done of inserting the electrode into the normal tissues all around the cancer to the desired depth. Then the electrode is inserted into the cancer itself at short intervals until the whole mass is desiccated out to the line of circular coagulation. The mass of tissue which has been coagulated is then lifted up with tenaculum forceps and removed with a sharp scalpel, the line of incision following the line of coagulation. There is no hemorrhage, as the blood vessels and capillaries have been sealed off by the coagulation process." The process of coagulation is not to be confused with cauterizing or burning. Excision of fatty tissue and glands is not advised, but the anterior neck area from the inferior maxilla to the clavicles is treated preoperatively and postoperatively with heavy doses of radium and the roentgen rays, in the hope of destroying the embryonal cells of a microscopic metastatic growth before it is large enough to be palpated. The coagulated area is removed for the comfort of the patient, because sloughing takes place within a few days.

Vincent's Infection: The field of therapy in Vincent's infection is covered by George O. Cummings (*New England J. Med.*, April 17, 1930) in a report based on 150 cases. The use of prescriptions containing mercuric chlorid combined with hydrogen peroxid is condemned because of the fact that there are so many other less poisonous antiseptics available. Mercurochrome in a 10 per cent solution is considered of some avail in early mild cases. Metaphen may be employed in an alkalinized 1:500 solution to flush out the gingival folds and is also considered of value as a mouth wash and gargle in a 1:5,000 solution. Silver nitrate should not be used about the gums as it is apt to stain the teeth permanently, silver proteinates are of practically no value and copper sulphate is apt to stain the teeth. Zinc sulphate in weak solution has nothing to recommend it except its astringent properties. Bismuth tartrate in a 30 per cent emulsion has been used as a topical application. Hydrochloric acid in weak solutions has sometimes been used about the gums, but is likely to damage the enamel of the teeth. Tincture of iodin is of little value. Hydrogen peroxid is beneficial as a mouth wash and gargle as it "bubbles away" necrotic material. Potassium permanganate has been used in weak solution as a germicide, but it has little to recommend it. Sodium perborate acts as a germicide and "bubbles away" débris. Many drugs of the phenol group give antiseptic qualities to mouth washes and gargles. Hexylresorcinol may be employed full strength to flush the gingival folds or may be used as a mouth wash or gargle. The use of trichloracetic acid as an escharotic or in solution is not recommended. Chromic acid is best applied in a solution from 2 to 10 per cent, but should not be used in excess because of the effect on the kidneys. The use of mouth

washes and gargles containing arsenic is to be condemned as there are less poisonous washes that are just as effective. Arsphenamin has been used, a 10 to 15 per cent solution in glycerin as a topical application, and its various forms have been employed intravenously. This drug in its different forms and methods of application the author considers the "sheet anchor" in the treatment of Vincent's infection. An intravenous injection of 5 c.c. of a 1 per cent solution of antimony and potassium tartrate has been advocated and might be worth remembering in a stubborn case that has not yielded to arsephenamin and local treatment. Ipecacuanha is of no value in this disease. The many analin dyes that have sometimes been used may permanently stain the teeth. Acriviolet or neutral acriflavin are sometimes used for their antiseptic qualities. Potassium chlorate is to be considered for its astringent qualities. As to treatment, when constitutional symptoms are present, the patient should be put to bed and treated as in any other acute condition. Cold or hot packs can be used on painful or swollen jaws. Mouth washes containing an astringent and a nonirritating antiseptic may be used for the comfort that they afford the patient. Topical applications are of value only in the mild cases, as the disease condition is in the gingival sulcus, which should be flushed out with a syringe having a blunt pointed needle set at an angle with the long axis of the syringe. For flushing, 1:500 solution of metaphen or hexylresorcinol is preferred to a 15 per cent solution of arsphenamin in glycerin. Most cases taken early will clear up within a week if this treatment is used daily. Treatment is supplemented by the home use of sodium perborate on pledgets of cotton and as a dentifrice. Toothbrushes should be sterilized and the teeth should be scaled after symptoms of the infection have disappeared. The author advocates the use of arsphenamin intravenously when more conservative methods have failed.

Foreign Literature

Caries Research (Hans Turkkeim, Fortschr. d. Zahnheilk. [Leipzig: Georg Thieme], No. 4, 1930, p. 312): The belief is still quite prevalent that caries of the teeth is more common during pregnancy than otherwise. Statistics afford the only basis for conclusions. Proper analysis of statistical data shows that there exists absolutely no connection between caries frequency and pregnancy. It is quite well understood that caries usually is most prevalent between the ages of 20 and 30; also, that most of the pregnancies fall in this period, and from this coincidence, many false conclusions are drawn. Statistics show that nonpregnant women, as well as men, during these ages manifest the same tendency to caries. It is age, therefore, rather than pregnancy that governs the incidence of caries. Driak of Vienna examined 1,100 persons in order to study this problem. His findings verify the foregoing observations. Caries is a little more common in women than in men; also, the teeth on the left upper and right lower jaws show 5 per cent more caries than the remainder of the mouth. The upper teeth are more frequently involved than the lower. The ratio of caries involvement of the upper to the lower jaws is as follows: 58.7:41.3. Approximal decay is twice as common in the upper jaws as in the lower jaws. Of the 1,100 patients examined, 531 were classed as well. The others suffered from hereditary syphilis, pernicious anemia, diabetes, arthritis, rickets, tuberculosis, carcinoma, nervousness and multiple sclerosis. Caries is not increased in anemia, pernicious anemia, diabetes and arthritis. It is increased in rickets and tuberculosis. Marked resistance is shown in hereditary syphilis and carcinoma; and in multiple sclerosis, the molars are more frequently involved than in other conditions.

Emil Mueller, Chicago.

Pathologic Histology of the Teeth (Karl Zilkens, Fortschr. d. Zahnheilk. [Leipzig: Georg Thieme] No. 4, 1930, p. 261): Investigations of Dubs, Greve and Nishimura, pertaining to the beginning of caries of the enamel, have shown that bacteria are not able to penetrate the enamel unless there is previous decalcification. Many examinations of the chalky areas of beginning caries revealed no bacteria. Only after the prismatic substance is decalcified and broken down and a cavity is formed are bacteria to be found. Those gram-positive staining bodies frequently observed as penetrating the enamel in advance of the caries are not bacteria but the matricea of the *Kalkkörncken.* Bödecker has been able to verify these observations. Akamatsu was able to find fat in the enamel or the dentin only rarely. In sixteen

temporary teeth examined, no fat was found. In thirty-two adult teeth, traces of fat were found in only eight. Akamatsu contends that the fatty degeneration usually demonstrated in conjunction with carious regions is not fatty degeneration, but a fatty infiltration from foods. Bauer disputes the contention of Gottlieb that hypoplasia of the enamel results from collapse of the enamel matrix because of failure of calcification. According to his observations, the enamel epithelium fails to develop the matrix; so that, in rickets for example, the maldevelopment is not due to lack of calcification primarily, but to a disturbance of the enamel epithelium. Wilson and Steinbrecker have reported cases of hereditary maldevelopment of dentin. They were able to trace it back through five generations. Becks has also described an interesting and unusual case of a girl, aged 13 years, who lost the enamel of all her teeth within a comparatively short time. The question concerning the occurrence of epithelium in the pulp has been very adequately presented within the last few years by both Orban and Kronfeld. Moen contributed a valuable study of twenty-five treated teeth of known history. All of the teeth studied were normal as determined by the roentgen-ray and clinical examination. While none of the canals were completely filled, they revealed remarkably favorable conditions about the apical portions of the unfilled canals. The pulp possesses almost unlimited recuperative powers if infection is not carried into it during treatment. This study should cast some doubt on the unfounded fear, so prevalent among American dentists, pertaining to the dangers that lurk in all treated teeth. Palozzi, as well as Wonnenmacher, has shown in experimental preparations of teeth for jacket crowns on human being and on dogs that it is very easy to produce injuries to the pulps by extensive grinding. In almost every instance, the odontoblastic layer degenerated and the pulps completely atrophied and, in some instances, necrosed. For clinical purposes, we should know that injury to the pulps must be expected in all instances when extensive preparations are made. Experience has taught us that many of these teeth with pulps thus injured function for years. We must therefore operate carefully, and periodically examine for pulp vitality all teeth extensively ground.

EMIL MUELLER, Chicago.

Influence of Nutrition on Teeth and Jaws (Walter Adrion, Deutsch. Monatschr. f. Zahnheilk. Vol. 48, No. 15, April 15, 1930): In studying the problem of the relationship between nutrition and teeth, we have to distinguish between two periods in the life of the tooth: the period of development and the period of use. Generally, it is acknowledged that, after the formation of a tooth, the diet cannot be expected to alter its reaction and structure. On the other hand, diet is of greatest importance to the forming tooth. The deciduous teeth seem to be less likely to be influenced by dietary factors, as the main part of their development occurs *in utero*, and the fetal organism is able to live on the body of the mother, even though she is very poorly nourished. The permanent teeth, most of which are built during the first months or first years of life, depend primarily on the diet for a normal structure and calcification. The author made experiments on puppies, which were fed on a diet with insufficient calcium and vitamin D. He showed that it is possible to influence the formation of the teeth and the calcification of the hard substances by eliminating either vitamin or calcium. In a case of complete absence of the vitamin D, the body is not able to make use of the calcium present in the foodstuffs. The best calcification is obtained by feeding calcium together with vitamin D (cod-liver oil).

RUDOLF KRONFELD, Chicago.

Protection Against the Effects of Roentgen Rays in Dentistry (W. Stemmer, Zahnaerztl. Rundschau, Vol. 1, pp. 1106-1110, 1929): Stemmer, a gynecologist, observed that many of the young patients who came under his observation on account of follicular cysts of the ovary were dental assistants. This led him to investigate the method of applying and using the roentgen-ray in dentistry. He found that the average time of exposure was seven seconds. The roentgen-ray dosage necessary for this purpose was 8-10 R, R being the unit for roentgen-ray dosage, and 600 R being called I HED, a biologic measurement indicating the amount of roentgen rays that can be received without harm to the skin. A patient would receive approximately 1 HED if he were exposed to roentgen-rays for from sixty to seventy-five films of the same spot. As this number of pictures is never taken of the same tooth, there is no

danger whatsoever to the patient. But it would be easily possible for this number of exposures to be made of a hand or finger of an assistant holding a film in a patient's mouth. It has been estimated that from eighty to 100 exposures would be sufficient to give the assistant's hand a roentgen-ray burn. The author measured the so-called roentgen-ray dispersion, that is, the flow of rays about the irradiated body and caused by a scattering of the rays as they hit a resistant material. He measured the dispersion of roentgen-rays on the chest of a dental assistant who was standing at the side of the patient, measurement being made by the use of a photographic film. By these measurements, it could be found that a dental assistant or nurse is endangered when more than twenty-four exposures daily are made. In such a case, it is absolutely necessary to protect these employees by a ray proof wall during the exposures.

RUDOLF KRONFELD, Chicago.

Experimental Changes in the Mesiodistal Relations of the Upper and Lower Arches (Carl Breitner, Ztschr. f. Stomatol., Vol. 28, No. 2, 1930): The changes that occur in the bone around a tooth that is moved orthodontically have been thoroughly studied in experiments. Up to this time no one has shown what changes take place if the entire mandible is moved forward or backward by orthodontic appliances (intermaxillary ligatures). Therefore, this paper is of outstanding interest to the orthodontist. Breitner's experiments were made on monkeys. The upper and lower arches of the teeth were each made an immovable unit by means of bridges which were connected by intermaxillary ligatures in order to force a mesial movement (protrusion) of the mandible. The experiments were continued for about three months. After this time, a considerable mesial displacement of the lower arch could be observed, corresponding to Class III (angle). Then, the monkeys were killed and the jaws and the joints sectioned mesiodistally. The slides showed that the mesial displacement of the lower arch took place in three different ways: by mesial movement of all teeth used for anchors; by an increase of the length of the mandible, a result of the new arrangement of the bone at the angle, at the ascending branch, and at the condyle, and by mesial displacement of the mandible by mesial wandering of the glenoid fossa. All these changes occur simultaneously, and it is not possible to influence or to produce one of them separately. By a proper arrangement of the forces applied, it is possible to influence especially the bone changes at a certain spot. The action of the intermaxillary rubbers is independent of the individual case; i. e., the same bone changes under the influence of a certain force are found in normal and in pathologic positions of the jaws.

RUDOLF KRONFELD, Chicago.

MISCELLANY

BOOK REVIEWS

Periodontal Diseases; Diagnosis and Treatment. By Arthur H. Merritt, D.D.S., F.A.C.D., F.A.A.P. 284 pages; 64 illustrations; price, $4; published by The Macmillan Company, New York, 1930.

It has long been known that Dr. Merritt is especially interested in periodontia, and this book is the result of years of study and clinical observation on his part. The author states that the book is intended primarily for the general practitioner and undergraduate student, and modestly intimates that the experienced periodontist will find little of interest in it. This is an attitude not usually found in an author, and, in this instance, the reader feels, it might logically be called "leaning over backwards," because, as a matter of fact, there is no periodontist who cannot find much of value in this volume. The manner of treating the subject is painstaking and comprehensive and each chapter is supplied with a liberal bibliography. The author has quoted extensively from previous writers and has been punctilious in his references. The reader may, therefore, through the medium of this volume, acquaint himself thoroughly with the literature of the subject. An important chapter is that on "Postoperative Care," which is one of the chief considerations in the management of disease of the supporting structures of the teeth. The illustrations are

good and supplement the text in a very satisfactory manner. The book as a whole is worthy of the highest commendation, and should receive the hearty support of the profession.

Necrotic Gingivitis (Trench Mouth). By Harold Keith Box, D.D.S., Ph.D., Research Professor of Periodontology, Faculty of Dentistry, University of Toronto. 63 pages; illustrated; distributed by the Canadian Dental Research Foundation as Bulletin No. 14.

The apparently increasing prevalence of this malady renders most interesting any treatise on the subject, and Dr. Box's small volume will, therefore, be welcomed as a contribution to the knowledge now obtainable. There is no implication that the last word has been said; in fact, Dr. Box intimates in his introduction that he is helping "to call attention to some of the unsolved problems in this important subject," and hopes to stimulate research along these lines.

Whenever Dr. Box undertakes to investigate any problem, he does it with the thoroughness characteristic of the research man, and he never leaves a subject without shedding light on it. It is to be hoped that before long a solution to the successful treatment of this disease will be available for the entire profession, and it can be said for the present treatise that it is another step in this direction.

The Elements of Anatomical Articulation or the Mathematics of Dental Prosthetics. Revised and rewritten by F. W. Rapp, Registered Dentist of N. S. W., Australia. Illustrated; 64 pages; price, 5 shillings; published by John Bale, Sons & Danielsson, Ltd., 83-91 Great Titchfield Street, W. 1, London.

The idea in this small volume is to place denture construction on an engineering basis, and accomplish it with instruments and appliances differing from the stereotyped or regulation articulators and other accessories used by the ordinary denture prosthetist. It is a difficult book to evaluate without a practical and extended test of the various procedures advocated, but it at least may be said that it is a departure from the beaten paths of literature on this subject and, therefore, offers much of interesting conjecture for the prosthetist to consider. In any event, the ideas are worthy of study on the basis that, with a subject so widely discussed and with so much variance of opinion, no theory should be ignored or carelessly swept aside without careful evaluation.

Textbook of Dentistry. Edited by Alfred Kantorowicz, Bonn; Carl Partsch, Breslau, and Christian Bruhn, Duesseldorf; in collaboration with other authorities. Volume 3: Prosthetic Dentistry. Edition 3. Munich: J. F. Bergmann, 1930.

Nowadays, a textbook is frequently written by several men, each an authority on one special phase of the subject. The material that has to be covered by a modern dental textbook, for instance, is too extensive to be handled by one man. In this volume, the subject of prosthetic dentistry is taken up by several authorities, and it is subdivided into different special sciences, dealing with the developments and investigations of each.

The first chapter, written by Professor Wustrow, of Würzburg, deals with the essentials of the technical laboratory and the materials used in it. He gives the history and methods of application of plaster, vulcanite and metals. Professor Loewe, of Breslau, in the next chapter, describes ways of taking impressions, making models and setting up teeth in dentures, as well as the manufacture of porcelain teeth (preparation, staining and burning), and finally discusses the merits of various artificial teeth on the market. The chapter following, on articulation, was written by Prof. Alfred Gysi of Zurich. Gysi gives a logical and comprehensive study of the physiology and motility of the joints, and presents a history of the development of the several articulators, with their advantages and disadvantages. He includes his own method of taking the bite, determining central occlusion and setting up teeth in a denture. Professor Wustrow wrote also the chapter on plates, explaining the materials and methods employed, the making of metal plates, partial dentures and clasps. The subject of crowns was covered by Professor Bruhn, of Duesseldorf. The preparation of the tooth for the crown; the making of metal crowns; the different methods of soldering, pressing and casting, and the shell and Richmond crowns are described. Especial emphasis is given to the repair and replacement of porcelain parts in crowns. The chapter on bridge construction was likewise written by Bruhn. It covers the clinical consideration and preparation of the abutment teeth, the types of bridges required in problematic cases, the

distribution of abutments and the choice of bridge construction in special cases. All the types of fixed and removable bridges are thoroughly reviewed, with special consideration of the work recently done in America in this field. The pathology of the loosening of teeth, together with the methods of fixation of such teeth, is described by the same author.

The chapter on the use of baked porcelain in dentistry was written by Dr. Ferdinand Gutowski, whose father was one of the pioneers in this field. The porcelain jacket crown, with its numerous problems, is given special attention, and the making of entire bridges and plates of porcelain is described. The last chapter, written by Dr. Kukulies, of Duesseldorf, deals with one of the most humane phases of dentistry, the restoration of a disfigured face by means of prosthetics. This work was developed during the war, and, as a result of it, thousands of soldiers who had been made social cripples by disfigurement from shells were restored to their places as useful members of society. The knowledge gained from these experiences is now used in cases of injury or surgical excisions necessitated by malignant growths.

This volume contains more than 1,000 pages, with 1,461 clear and instructive illustrations. A comprehensive bibliography of both the German and foreign literature is given at the end of each chapter.

RUDOLF KRONFELD, Chicago.

Public Health Aspects of Dental Decay in Children. Published by the American Child Health Association, 370 Seventh Avenue, New York. Price, paper binding, 136 pages, $1.00; cloth binding, $1.25.

The third monograph in the School Health Research Series deals with analyses of mouth records of 7,500 children of the fifth and sixth grades in many cities of the country, as well as of several thousand children of preschool age. This is contributory to the development of an evaluation formula which, in the final volume of the series, can be applied to each of the school groups which have been studied, for the purpose of determining one phase of the efficacy of school health programs. The subject matter covers measurable aspects of oral hygiene, the continuity of decay, the influence of enamel defects and of fillings on decay, occurrence of stain, tartar and gingivitis and control factors in their relation to studies of mouth conditions.

NEWS

Officers of Alabama Dental Association: Following are the newly elected officers of the Alabama Dental Association: president, J. E. Brown, Jr., Mobile; first vice president, W. S. Wilson, Fairfield; second vice president, R. J. McGavock, Birmingham; secretary-treasurer, Frank F. Perry, Montgomery.

Medical College of Virginia Commencement: George E. Vincent, retiring president of the Rockefeller Foundation, will give the commencement address at the Medical College of Virginia, Richmond, Tuesday, June 3. At this time, approximately 190 will be graduated from the schools of medicine, dentistry, pharmacy and nursing.

DEATHS

Bailey, Earle R., Chicago, Ill.; University of Illinois, College of Dentistry, 1905; died, April 27.

Hajicek, John E., Chicago, Ill.; Chicago College of Dental Surgery, 1906; died, March 15.

Mitchell, George D., Chicago, Ill.; died, May 2; aged 60.

Munroe, Grafton, Springfield, Ill.; University of Pennsylvania, School of Dentistry, 1885; died, March 7; aged 66.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Denver, Colo., July 21-25.

American Academy of Periodontology, Colorado Springs, Colo., July 17-19.

American Board of Orthodontia, Denver, Colo., July 26.

American Dental Assistants Association, Denver, Colo., July 21-25.

American Dental Hygienists Association, Denver, Colo., July 21-25.

American Full Denture Society, Denver, Colo., July 18-19.

American Society of Oral Surgeons and Exodontists, Evergreen, Colo., July 18-19.

Australian Dental Association, Brisbane, July 7-12.

International Dental Federation, Paris, France, August, 1931.

International Orthodontic Congress, London, England, July 20-24.

National Association of Dental Examiners, Denver, Colo., July 21-22.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

June

Arkansas, at Little Rock (2-4).
Georgia, at Atlanta (11-13).
Maine, at South Poland (19-21).
New Hampshire, at Laconia (4-6).
Southern California, at Riverside (2-4).

July

Wisconsin, at Milwaukee (8-10).

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, June 23. E. W. Patton, Secretary, 1807 Comer Bldg., Birmingham.

Arizona, at Phoenix, July 14. W. M. Johnson, Secretary, 1105 Luhrs Tower Bldg., Phoenix.

Arkansas, at Little Rock, June 23. Floyd P. Travis, Secretary, Osceola.

California, at San Francisco, May 24, and Los Angeles, June 21. Bert Boyd, Secretary, 610 S. Broadway, Los Angeles.

Connecticut, at Hartford, June 25-28. Almond J. Cutting, Recorder, Southington.

Delaware, at Wilmington, June 18-19. W. S. P. Combs, Secretary, Middletown.

Florida, at Jacksonville, June 30-July 2. R. P. Taylor, Secretary, 414 St. James Bldg., Jacksonville.

Indiana, at Indianapolis, June 12-16. J. M. Hale, Secretary, Mt. Vernon.

Kentucky, at Louisville, June 6-10.

Maine, at Augusta, June 30-July 2. Alton H. Swett, Secretary, 192 State St., Portland.

Massachusetts, at Boston, June 10-14. W. Henry Grant, Secretary, State House, Boston.

Michigan, at Ann Arbor, June 16-21. J. W. Lyons, Secretary, Union and Peoples Nat'l Bank Bldg., Jackson.

Minnesota, at Minneapolis, June 12. W. H. Smith, Secretary, 601 Donaldson Bldg., Minneapolis.

Mississippi, at Jackson, June 17-20. T. Ford Leggett, Secretary, Laurel.

Missouri, at St. Louis, June 11-14. George E. Haigh, Secretary, Central Trust Bldg., Jefferson City.

Montana, at Helena, July 14-18. T. P. Regan, Secretary, Helena.

Nebraska, at Lincoln and Omaha, June 10-12, at Lincoln, June 12-14. Mrs. Clark Perkins, Director, Bureau of Examining Boards.

Nevada, at Reno, June 2. G. C. Steinmiller, Secretary, P. O. Box 274, Reno.

New Jersey, at Trenton, June 23. John C. Forsyth, Secretary, 148 W. State St., Trenton.

New Mexico, at Albuquerque, July 16-18. J. J. Clarke, Secretary, Artesia.

North Dakota, at Fargo, July 8-11. Gilbert Moskau, Secretary, Grand Forks.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Oklahoma, at Oklahoma City, June 23-26. E. E. Sanger, Secretary, Yukon.

Pennsylvania, at Philadelphia and Pittsburgh, June 18-21. W. A. McCready, Secretary, 1115 Highland Bldg., Pittsburgh.

Rhode Island, at Providence, June 24-26. Albert L. Midgley, Secretary, 1108 Union Trust Bldg., Providence.

South Carolina, at Greenville, June 24-26, W. H. Sherard, Secretary, Anderson.

South Dakota, at Sioux Falls, June 28. G. G. Kimball, Secretary, Mitchell.

Tennessee, at Memphis, June 16. F. W. Meacham, Secretary, 911 Hamilton National Bank Bldg., Chattanooga.

Vermont, at Montpelier, July 1-2. David Manson, Secretary, Burlington.

Virginia, at Richmond, June 10. John M. Hughes, Secretary, 715 Medical Arts Bldg., Richmond.

FLORIDA STATE BOARD OF DENTAL EXAMINERS

(Change of Dates)

The annual examination of the Florida State Board of Dental Examiners will be held, June 30-July 2, instead of June 26-28 as previously announced.

R. P. TAYLOR, *Sec'y-Treas.*,
Jacksonville.

MICHIGAN STATE BOARD OF DENTISTRY

The next meeting of the Michigan State Board of Dentistry will be held at the Dental Building, Ann Arbor, June 16-21, for the purpose of examining applicants to practice dentistry and dental hygiene.

J. W. LYONS, *Secretary,*
1405 Union and Peoples Nat'l Bank Bldg.,
Jackson.

AMERICAN BOARD OF ORTHODONTIA

A meeting of the American Board of Orthodontia will be held in Denver following the American Dental Association meeting. Those orthodontists who desire to qualify for a certificate from the board as outlined in the article entitled, "The American Board of Orthodontia," page 50, the January issue of the *International Journal of Orthodontia, Oral Surgery and Radiography,* can receive full information and application form from the secretary of the board.

ALBERT H. KETCHAM, *President,*
1232 Republic Bldg.,
Denver, Colo.

OREN A. OLIVER, *Secretary,*
1101 Medical Arts Bldg.,
Nashville, Tenn.

ASSOCIATION OF THE ALUMNI OF THE SCHOOL OF DENTAL AND ORAL SURGERY OF COLUMBIA UNIVERSITY

The Association of the Alumni of the School of Dental and Oral Surgery of Columbia University will hold the last meeting of the year at the Columbia Club, 4 West 43rd St., New York City, at 8 p. m. Important business will be transacted and officers will be elected.

M. M. MASLANSKY, *Secretary,*
57 West 57th St.,
New York City.

GREATER NEW YORK DECEMBER MEETING FOR BETTER DENTISTRY

The Sixth Greater New York December Meeting for Better Dentistry will be held at the Hotel Pennsylvania, New York City, December 1-5. A program of essays and clinics will be presented, with progressive teaching clinics along various lines an important feature. Topic discussions will again be a part of the program. A manufacturers' exhibit will be held in the hotel simultaneously with this meeting.

JOHN T. HANKS, *Chairman,*
CHARLES M. MCNEELY, *Vice Chairman.*

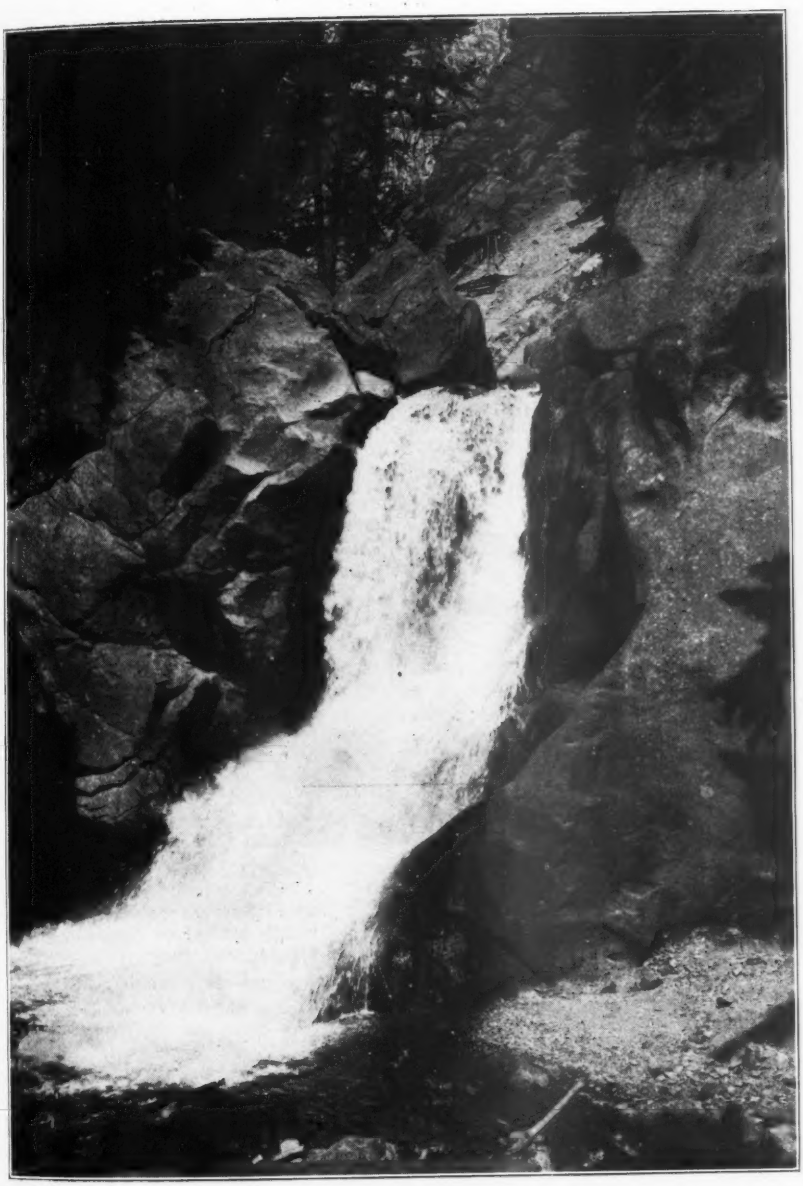
SOUTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

The annual meeting of the South Carolina State Board of Dental Examiners will be held at Greenville, at the Imperial Hotel, June 24-26.

W. H. SHERARD, *Sec'y-Treas.*
Anderson.

MISSOURI DENTAL BOARD

The next meeting of the Missouri Dental Board will be held, June 11-14, at Wash-



Boulder Falls, Colorado

ington University Dental College, St. Louis. For further information address

GEORGE E. HAIGH, *Secretary,*
Central Trust Bldg.,
Jefferson City.

SECOND INTERNATIONAL ORTHODONTIC CONGRESS

The Second International Orthodontic Congress will be held in London, England, July 20-24, at the Hotel Great Central. The officers of the congress are: president-general, J. H. Badcock; vice president-general, G. Northcroft; treasurer-general, E. D. Barrows; secretaries-general, A. C. Lockett and B. M. Stephens. A full program of papers and demonstrations is anticipated and a museum is being organized. Suitable entertainment for ladies accompanying members will be arranged. Those dentists desiring to contribute to the activities of the congress can obtain from the secretaries of their respective orthodontic (or dental) societies a statement as to the conditions under which contributions are invited. Secretary General Mr. A. C. Lockett, 75 Grosvenor St., London, W. 1, will furnish any further information desired on request. Information regarding traveling facilities and hotel accommodations may be obtained from the official agents to the congress, Messrs. Morgan Pope & Co., 7 St. James St., London, S. W. 1; 6 Rue Caumartin, Paris, 71 Vanderbilt Ave., New York City; Messrs. Noel Vester & Co. (agents), 44 Unter den Linden, Berlin.

J. H. BADCOCK, *President-General,*
A. C. LOCKETT and
B. MAXWELL STEPHENS,
Secretaries-General.

WOMEN'S AUXILIARY OF THE A. D. A.

The Women's Auxiliary of the American Dental Association is a social organization for the women attending the national meetings. The wives of all members of the A. D. A. are eligible to membership and are urged to join this friendly group. The dues are nominal, $1 a year. We are especially anxious to have a large membership from Colorado this year in honor of the meeting in Denver. The annual business meeting of the Women's Auxiliary will be held Monday morning, July 21, at 10 o'clock in the Cosmopolitan Hotel and the "Acquaintance Luncheon" (one dollar a plate) the same day at one o'clock in the Arabian Room, Cosmopolitan Hotel. You are cordially invited to both affairs. Colorado women are asked to send the money for the luncheon tickets to the undersigned not later than July 18.

MRS. HENRY F. HOFFMAN,
Vice President for Colorado,
700 Majestic Building,
Denver.

RAILROAD RATES TO DENVER

SUMMER TOURIST FARES will be in effect from all points in the United States to Denver. These rates are less than the fare and one-half usually granted the American Dental Association, and **NO CERTIFICATES** will be needed by our membership.

Canadian Passenger Associations will also have the summer tourist rate in effect.

These rates will apply to any one regardless of whether or not they are members of our Association.

SEE YOUR LOCAL AGENT FOR DETAILS.

Transportation Committee,

R. L. SPRAU,
HARRY W. NELSON,
W. F. NORTHRUP,
O. J. SPECKER,
HARRY B. PINNEY, *Chairman.*

PACKAGE LIBRARIES*

COMPILED BY AND AND AVAILABLE FOR CIRCULATION

FROM

THE LIBRARY BUREAU

OF THE

AMERICAN DENTAL ASSOCIATION
58 E. Washington St., Chicago, Ill.

Absorption of roots and bone.
Alveolar process—its structure, anatomy and resorption.
Alveolectomy.
Amalgam fillings and physical properties of amalgam.
†Anesthetics in children's dentistry.
Apicoectomy.
Articulation, occlusion and mandibular movements.
†Bacteriology.
Best time for orthodontic treatment.
†Blood count in focal infection.
†Bridges using inlays as abutments.
Business side of dentistry.
Cancer of mouth.
Cast gold inlays.
Casting gold, including inlays and dentures.
Cavity preparation.
†Child psychology.
Children's dentistry.
Cleft lip and palate.
Community and school dental service.
Comparative dental anatomy.
Condyle path movements.
†Congenitally missing teeth.
Contraindications in and untoward results from the use of local anesthetics.
†Contributions dentists have made outside their profession.
†Curetting.
Cysts.
†Deciduous teeth and their relation to permanent dentition.
Dental assistants.
†Dental care of the preschool child.
Dental caries.
†Dental cements.
Dental clinics.
†Dental disease and practice in the tropics.

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*Each package library contains information on one of the subjects listed and is composed of reprints, magazine clippings, etc., on that subject only. The packages are loaned to members of the Association for a period of one week after date of receipt. Unless the material is reserved for another borrower, an extension of time will be granted on request. The charge for borrowing a package library is 50 cents. The rental fee should accompany the request for a package library. No packages are sold. In response to requests, packages will be compiled on other subjects pertaining to dentistry.

†These packages contain less than the usual number of articles.

Dental economics.
†Dental erosion.
Dental ethics.
Dental hygienists.
†Dental nomenclature.
Dental health education.
Dental service in the World War.
Dentifrices.
Dentistry as a career and the status of the dentist.
Denture casting.
Diet and nutrition in relation to teeth.
Diet in pregnancy.
†Dry socket.
†Education of denture patients.
†Emphysema.
Endocrine glands in relation to teeth.
†Eruption of teeth and accompanying symptoms.
Esthetics in denture construction.
Ethyl chlorid.
Ethylene anesthesia.
Etiology of caries.
Etiology of malocclusion and preventive orthodontia.
†Etiology of pyorrhea and its relation to systemic conditions.
Evolution of human dentition.
Examination of the mouth and oral diagnosis.
Extraction of teeth.
First permanent molar.
Fixed and removable bridgework.
Focal infection.
Focal infection in relation to diseases of the eye.
Foreign bodies (of dental origin) in the lungs and esophagus.
Fractures of the jaws.
Full denture construction.
Gold foil.
Habits as factors in malocclusion.
†Hemophilia or excessive hemorrhage following extraction.
Hereditary influences in malocclusion.
†High frequency in dentistry.
†Histologic examinations of fractured roots.
†Histologic study of teeth and tissues.
History and progress of dentistry.
History of dentistry.
Hospital dental service.
†Hypercementosis and excementosis.
Impacted teeth and their removal.
Impacted third molars.
Impression technic.
Impressions for inlays.
Indirect inlay technic.
Industrial dental service.
†Infection following extraction of teeth.
†Influence of diet on saliva.
†Influence of syphilis and fevers on tooth form and structure.
Interpretation of roentgenograms.
Ionic medication.
Lectures to nurses.

Local anesthesia.
†Ludwig's angina.
Mandibular movements.
Materia medica and pharmacology.
Maxillary sinus and antrum—diseases and treatment.
Methods of sectioning and staining teeth.
Monson's theory.
Mottled enamel.
Mouth hygiene.
Muscle exercises and training in orthodontia.
Nitrous oxid-oxygen anesthesia.
Oral diagnosis.
Oral diagnosis with reference to roentgen ray.
Oral manifestations of systemic conditions.
Organized dentistry.
Orthodontia and its relation to dentistry and medicine.
Orthodontic appliances.
Orthodontic education.
†Orthodontic treatment of impacted cuspids.
Osteomyelitis of the jaws.
Partial dentures.
†Permeability of tooth structures.
Physical therapy in dentistry.
†Pinledge and pinlay attachments.
Place of extraction in orthodontic treatment.
Porcelain.
Porcelain inlays.
Porcelain jacket crowns.
Postoperative complications and care.
†Postoperative psychosis.
†Pregnancy and dental disease.
Preoperative examination of patients.
†Preparation of cavities with hypersensitive dentin.
Preventive orthodontia.
Procain (novocain) dermatitis.
†Program building for state and district societies.
Prophylactic odontotomy.
Pulp conservation including pulp capping and cavity lining.
†Pulp stones.
Pyorrhea.
Relation between dental conditions and mental health of insane.
†Retrusion of the mandible causing impaired hearing.
Root canal treatment.
School dental service.
Should dentistry be advertised?
Sterilization of dental instruments.
Stomatology.
Studies of saliva.
Suggestions for a talk to mothers.
†Supernumerary teeth.
Surgical treatment of pyorrhea.
Three-quarter crowns.
Tooth arrangement for full dentures.
Toothbrushes and toothbrush containers.
Toothbrushes, tooth pastes and mouth washes.
Traumatic occlusion.

Trigeminal neuralgia.
†Tuberculosis and dentistry.
Ultraviolet ray in the treatment of pyorrhea.
Ultraviolet ray therapy in dentistry.
Use of elevators in extraction.
Value of dental service in schools.
Value of roentgen-ray examinations in orthodontia.
Vincent's infection.

Denver Museum of Natural History in City Park; containing a million dollar exhibit of the fauna of Western America.

AMERICAN DENTAL ASSOCIATION

Denver, Colorado. July 21-25, 1930.

HOTEL RESERVATIONS

In securing hotel reservations for the 1930 Session, consult the hotel rate-sheet and fill out the blank application below. Mail immediately to the hotel you wish to patronize. The hotel will then advise you of the reservation that has been made for you.

Kindly indicate second and third choices.

Please remember that reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, please write or wire the hotel, releasing it.

MAIL THIS APPLICATION DIRECT TO THE HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, DENVER, COLO., JULY 21-25, 1930 .....

.....Hotel. 1930

Please reserve sleeping room accommodations noted below:

.....Room(s) with bath for.....people. Rate desired $..... (per day)

.....Room(s) without bath for.....people. Rate desired $..... (per day)

Second choice: .....

Third choice: .....

ROOMS TO BE OCCUPIED BY:	ADDRESS IN FULL
.....	.....
.....	.....
.....	.....

Please confirm this reservation to applicant. I further agree to notify the hotel at once in the event I am unable to use this reservation.

IMPORTANT TO HOTEL MANAGER: In the event you cannot accept this reservation, please forward this application at once to Dr. I. R. Bertram, Chairman Halls and Hotels, 1222 Republic Bldg., Denver, Colorado, who will attend to its assignment.

HOTEL	Rooms	Single with Bath	Double with Bath	Single without Bath	Double without Bath
ADAMS 18th & Welton	115	$3.00-5.00	$4.00-6.00	$2.00-2.50	$3.00-4.00
AMBASSADOR 1728 California	92	2.00	2.50	1.50	2.00
ALBANY 17th & Stout	300	3.00-6.00	5.00-10.00	2.00-3.00	4.00-6.00
ARGONAUT 233 E. Colfax	160	4.00	5.50	2.00	3.00
AUDITORIUM 14th & Stout	200	2.00-3.50	3.00-5.00	1.50-2.00	2.50-3.00
AYRES 1441 Logan	75	3.50 up	5.00-6.00	2.50	4.00
BROWN PALACE 17th & Tremont	300	5.00 up	8.00 up		
COLBURN 10th & Grant	100	3.50-5.00	5.00-8.00		
COLORADO 17th & Tremont	100	2.50-3.00	4.00-5.00	1.50-2.00	2.50-3.00
COSMOPOLITAN 18th & Broadway	460	3.00-5.00	5.00-10.00	1.50-2.00	2.50-4.00
CREST 1924 Welton	114	2.00 up	3.00 up	1.50	2.00
EDELWEISS 1651 California	76	3.00	4.00	2.00	3.00
HARVARD 501 E. Colfax	60	2.50	3.50	1.50	2.50
KENMARK 530 17th	120	2.50-3.50	4.00-6.00	1.50-2.50	2.50-4.00
LANCASTER 1765 Sherman	75	2.50	3.00-5.00	2.00	2.50
MARQUETTE 1725 Curtis	62	2.00	4.00	3.00	3.00
MAYFLOWER 1710 Grant	80	2.50-3.50	3.50-5.00	1.50-2.00	3.00-3.50

(*Continued on next page*)

HOTEL	Rooms	Single with Bath	Double with Bath	Single without Bath	Double without Bath
MIDLAND 1106 17th	70	3.00	4.00	1.50-3.00	2.00-3.00
MILLS 1321 Logan	60	2.50	4.00	1.50	2.00
NEWHOUSE 1470 Grant	77	3.00	5.00	2.00-2.50	3.00-3.50
OLIN 1420 Logan	125	2.50-4.00	6.00		
O'NEILL 1407 Stout	60	2.00	3.50	1.50	2.50
OXFORD 1612 17th	250	3.50	5.00	2.00	3.50
PAGE 1320 Stout	65	2.00-2.50	3.00-3.50	1.50	2.00
PARK LANE 450 S. Marion			10.00		
PLAZA 330 15th	60	2.00-2.50	3.00-3.50	1.50	2.00-2.50
SEARS 1755 California	94	2.50-3.00	3.00-8.00	2.00	2.50-3.00
SHIRLEY-SAVOY 17th & Broadway	400	3.00-5.00	5.00-8.00	2.00-2.50	3.50-4.00
STANDISH 1530 California	125	2.50	3.50	1.50	2.50
WELLINGTON 1450 Grant	75		3.50		
WEST 1337 California	112	2.50	3.50	1.25-1.50	2.00-2.50
WYNNE 1431 California	100	2.00 up	3.00 up	1.50	2.00
WEST COURT 1415 Glenarm Place	129	2.50 up	3.00 up	1.50	2.00

OFFICERS AND TRUSTEES OF THE AMERICAN DENTAL ASSOCIATION

1929-1930

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R. Boyd Bogle.....Medical Arts Bldg., Nashville, Tenn.

PRESIDENT ELECT

Robert Todd Oliver.....210 S. 39th St., Philadelphia, Pa.

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Harry B. Pinney.....58 E. Washington St., Chicago, Ill.

TREASURER

R. H. Volland.....Iowa City, Iowa

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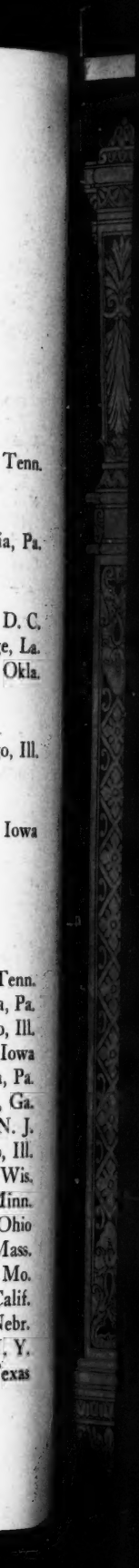
R. Boyd Bogle, President, Ex-Officio.....Medical Arts Bldg., Nashville, Tenn.
Robert Todd Oliver, President Elect, Ex-Officio...210 S. 39th St., Philadelphia, Pa.
Harry B. Pinney, Secretary, Ex-Officio.....58 E. Washington St., Chicago, Ill.
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